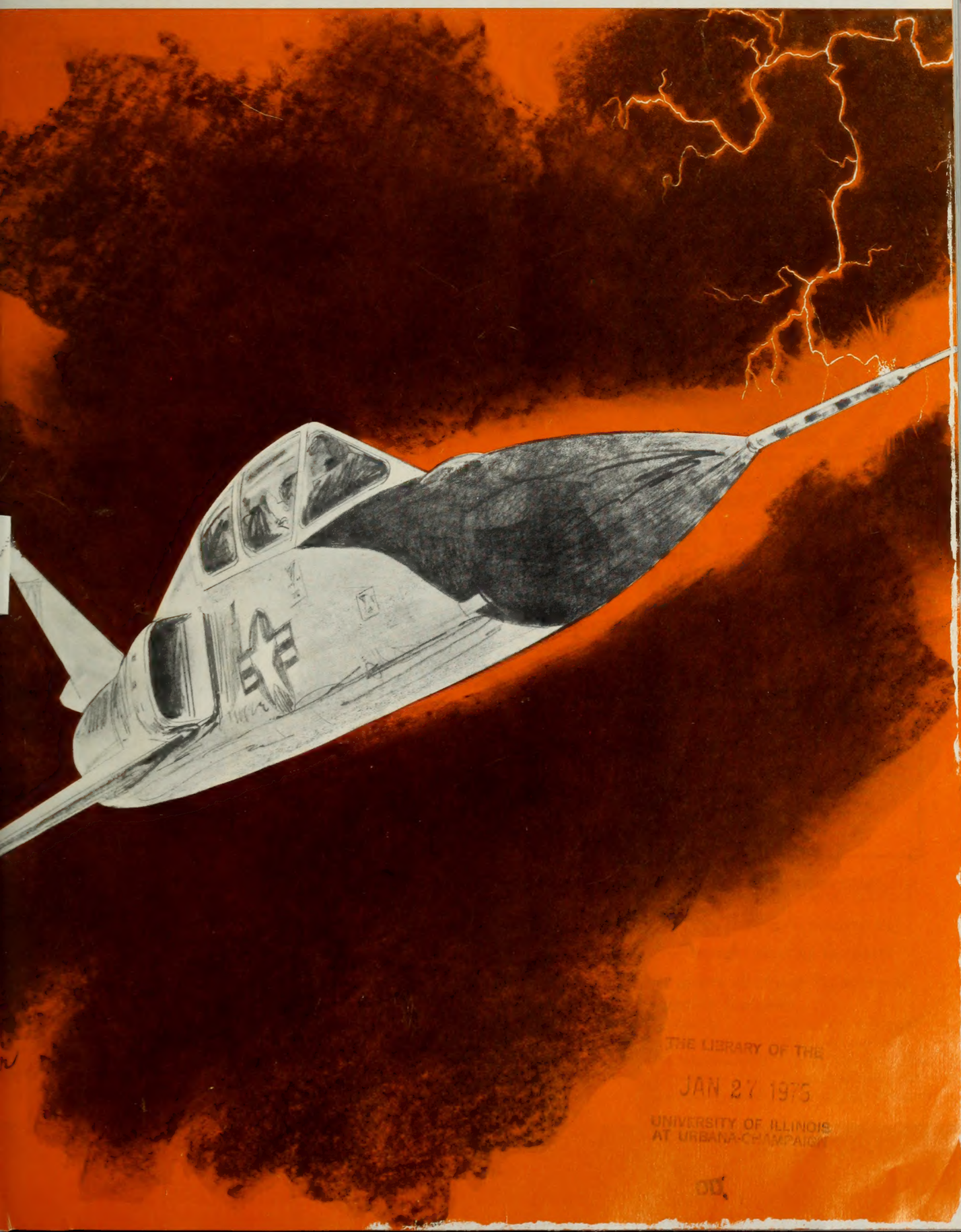
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JANUARY 197



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UNITED STATES AIR FORCE JANUARY 1975

AEROSPACE SAFETY

THE MISSION - - - - - - SAFELY!

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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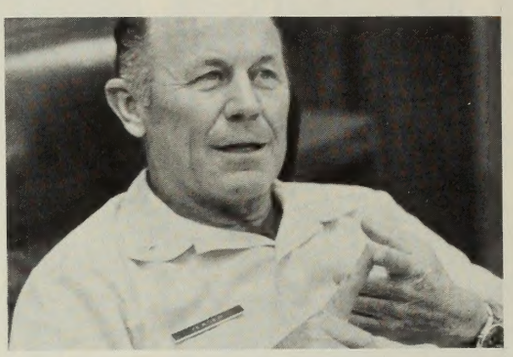
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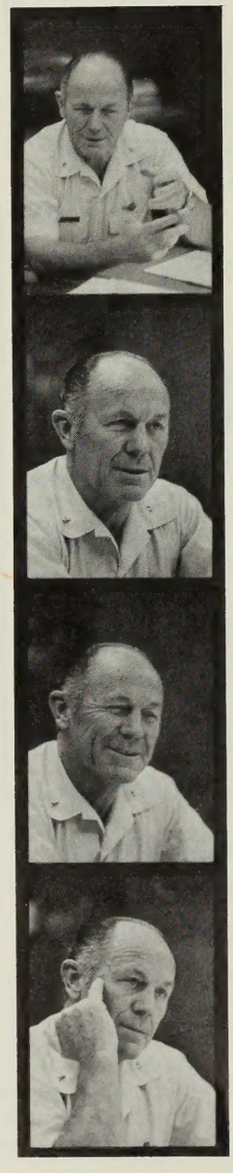
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Thoughts On Safety

Mark Hunter Interviews Brigadier General Charles E. Yeager, Director, Aerospace Safety





Mark Hunter: Sir, since we are starting a new calendar year, will we at the Safety Center be starting any new safety programs or initiating any new techniques designed to prevent accidents?

Gen Yeager: Everybody looks forward to a new year so they can wipe the slate clean and start new safety statistics, but accident prevention doesn't work that way. We depend upon past experience to come up with new safety programs, but experience isn't something that starts over with the new year. The basics of accident prevention remain constant. To prevent accidents we research the files to find out what caused past accidents and then work to correct the cause factors. In this manner our history dictates, to a great degree, what our safety program consists of.

While the basics remain constant, we have plans to gradually erode the lines separating safety disciplines, to lessen accident reporting duplication, and introduce new safety educational techniques. There will be a different relationship between safety and inspection. I look forward to the day when our accident recommendations, something we said ought to be done, will automatically become part of an inspector's checklist at numbered air force, command, or Air Force level. You'll see greater coordination and cooperation between the services and greater involvement by the Department of Defense in military safety programs.

Mark Hunter: Have we redirected our efforts as a result of last year's accidents?

Gen Yeager: As we said in the beginning of 1974, 'last year we didn't invent any new ways of tearing up aircraft.' Take human error, for example, because it is involved in so many accidents; we can train, educate and supervise the pilots, maintenance people and the designers, but, because these people frequently change jobs or graduate into supervisory positions, we are constantly faced with a new group of people who have to learn the same lessons of the past. The newer pilots coming into the system, or the newer maintenance officers, or crew chiefs seem to make the same mistakes that the old ones did. If we had the same pilots flying the same airplanes from now on, our job would be a lot easier. That's the toughest part of the safety business: we see the same types of accidents happening over and over.



World War II ace, first man to fly faster than the speed of sound, test pilot, member of the Aviation Hall of Fame, Director of Aerospace Safety, are some of the accomplishments of Brig Gen Yeager.

Mark Hunter: There doesn't seem to be any hope for stopping this type of accident then?

Gen Yeager: If you look at the accidents that occur and our accident rate—it runs in cycles. Primarily it has to do with the emphasis that is placed on supervision. When we get good supervision from the top down, our accident rates go down. The moment that we relax and everybody gets a complacent attitude, the accident rates go up.

Mark Hunter: You don't think we'll ever be faced with having to eliminate the last safety hazard?

Gen Yeager: No. The Air Force is ever-changing. We must be flexible, to respond to different foreign policy, weapons systems or environments in which to operate. The Air Force will never be, in my opinion, a static organization because these things are never static. We have to change every day; we can't become stale or stagnant. We could probably wipe out every accident if we were a static organization, but things are just not that way. We could be called to operate in either arctic or tropical conditions; new weapons systems are being introduced practically every month. We change tactics in response to some of the red block countries' weapons systems. We also are faced with budget constraints and the energy crisis, so we have to cut back on flying time yet still maintain constant readiness, and the list goes on.

Mark Hunter: Are there any problems that will influence safety during 1975?

Gen Yeager: Yes. The cost of new equipment has risen drastically, while the budget has stayed about the same. This means we must cut down on many of the support type functions and will lose people as well. The money we save by going to a hard core Air Force will be used for new weapons systems that are in direct support of our mission. Our people will have to work smarter because we are going to have fewer people doing the job, and the job will have to be done right the first time. The rising cost of people and equipment makes our job in safety even more important.

Mark Hunter: Are we seeing the results today from our past efforts?

Gen Yeager: Definitely. For example, in Systems Safety we have been able to make our inputs into the weapons systems early enough to influence the designers. Our weapons systems are much safer today when they roll out of the factory than they were a few years ago. All types of safety specialists are involved in this effort. Murphy's Law doesn't apply anymore like it did in the past, you know: "If a thing *can* be put together wrong, it *will* be put together wrong." We've got our life sciences people involved in this, maintenance people, engineers and system safety specialists, all working to give us a better piece of equipment. The guys who work on our airplanes are a lot sharper, better trained and have better equipment to work with. Our accident rate has gone down on a rather constant curve through the last few years.

Mark Hunter: Can we safety people take most of the credit for this reduced accident rate?

Gen Yeager: Some, but the real safety officer in all of the different organizations in the Air Force is the commander. If that guy implements a good safety program and really rides herd and supervises his people, then he has a good accident rate. And that goes from the Chief of Staff on down. If the commander does not recognize and accept responsibility for his safety program, all the safety officers in the world are not going to prevent accidents. ★





Lt Col Charles A. Lehman, Cmdr 3612 CCTS, the Air Force Survival School at Fairchild AFB, Washington, accepts SAFE Meritorious Service Award from A. J. Van Haastert, president of SAFE, an association of persons from the military and civilian communities interested in life support. Lt Col Lehman received the award at the annual SAFE conference in Las Vegas, last September. The award is given for outstanding performance in the area of aircrew support. The award to Lt Col Lehman was based on his achievements as a life support officer, among which were a leading role in establishing the ADC life support program, starting the PACAF Water Survival School, and service as the life support officer for Seventh Air Force during the Vietnam war.

POWs and LSE*

*LIFE SUPPORT EQUIPMENT

LT COL CHARLES A. LEHMAN

This is the first of two articles dealing with the in-flight escape and use of life support equipment by returned POWs. The articles are based on papers presented by members of the Life Sciences Division, Directorate of Aerospace Safety, at the 12th annual SAFE conference at Las Vegas, 8-12 September 1974.

For many years all the military services have collected data on ejection/bailout/survival episodes of crewmembers who were involved in aircraft accidents. More recently the United States Air Force (USAF) began collecting similar life sciences data from crews recovered after combat losses.

This article provides the first real insight into the life support problems encountered by a third group—our returned prisoners of war (POWs). The returnees were queried by mail as part of a joint HQ USAF and Air War College sponsored study. Colonel Joe Kittinger developed the format used to query USAF returnees concerning their experience with aircraft egress, life support equipment, and mission data. Our statistics are based on the 209 questionnaires received of the 218 sent to the returnees. The POW responses were anonymous and voluntary.

It is important to remember that these reports come only from survivors. We know little or nothing of those who received fatal injuries during their ejection/bailout attempts. Also, it seems unlikely that many of those who incurred really severe ejection injuries were able to withstand the rigors of capture and confinement. We have no information on those individuals either.

The experiences of the POWs who returned will be compared to the experiences of successful evaders and noncombat survivors.

The returnees generally entered their ordeals under extremely trying circumstances. The higher speed of their ejections, the violent breakup of many of their aircraft, wounds sustained in flight, or injuries incurred

during parachute landing resulted in more than one out of five being incapacitated when entering the evasion challenge. These injuries had a very direct bearing on the outcome of their evasion attempts.

"I believe that only severe injuries prevented me from evading and possible rescue."

This man had burns on face and neck, a compressed disc, internal injuries and bleeding, two possible breaks in his pelvis, and numerous cuts and bruises. He still evaded for 20 hours.

The flight gear worn by these aircrews was a significant factor in their escape from combat-damaged aircraft. As the canopy was jettisoned prior to ejection, the flight helmet served to protect the crewman from windblast and seat-man contact. However, 19.6 percent of the returnees who ejected (and reported the status of their helmets) said that they lost their helmets during the ejection sequence. In spite of the preponderance of high-speed ejections, this rate is close to the noncombat helmet loss rate (16.6 percent) or the successful evaders' rate (16.4 percent). Generally, the returnees' rate of helmet loss increased quite uniformly with speed, but there is a dramatic drop in the curve between 450 and 500 knots. This may be due to the relatively small sample at that speed range (20). The low rate between 200 knots and 350 knots was also somewhat unexpected, but may be due to the optimum stability of many of our ejection seats in that speed range.

Configuration of the helmet during the ejection/bailout sequence is a key factor in its retention or loss as the following retention rates indicate:

	RETENTION RATE
Visor down chin and nape strap snug (Optimum configuration)	
Combat	85%
Noncombat	88%
Visor down straps loose	
Combat	84%
Noncombat	89%
Visor up	
Combat	74%
Noncombat	69.5%

In view of the high speed of most of these ejections, the relatively good retention rate may be partially explained by considering that crewmembers in combat usually keep their emergency equipment tight and well fitted. In day to day noncombat flying, they are more lax in this respect. The configuration of the successful evaders' helmets is not known.

Only four helmet failures were reported by the returnees. Three involved broken visors, while one helmet was struck by a cannon shell fired from a MIG. The aircraft canopy and helmet shell absorbed enough of the impact that the pilot was not seriously hurt.

The 209 reporting returnees described their landing sites: More than a third of the returnees began their evasion attempts in thick brush or trees. Thirty-one percent impacted on hard ground and 16 percent on soft ground. Ten percent hit amid rocks, and more than one-fifth made their parachute landings on steep slopes or ravines. In spite of the unfavorable terrain, there were only 12 major injuries and 26 minor injuries attributed to parachute landing. In a recent three year period, noncombat ejectees experienced a parachute landing fall (PLF) major injury rate of 8.6 percent.

Only three percent of the returnees landed in water compared to 19 percent of the successful evaders. Obviously, those crews who made it "feet wet" before ejecting fared better than those who were forced to eject over land.

Capture came rapidly for most of the returnees, just as rescue was quick for most of those who made it back. Many of the returnees were literally captured as their feet touched the ground. Within their first two hours on the ground, 65 percent of the returnees had been captured. In that same interval, 49 percent of the successful evaders were rescued. At the end of six hours on the ground, 70 percent of the returnees had been captured and 75 percent of the evaders rescued. In the densely populated sections of the enemy area, long evasion episodes were not the rule. This would probably be true in future daylight operations in any densely populated area of the world.

Even so, there were some amazing, extended evasions among the returnees. Six of them avoided the enemy for more than three days. Of these, two lasted a week and one, eight days. One, who was captured immediately, escaped and evaded for two weeks before being shot and recaptured. In a densely populated country where an occidental stands out like a sore thumb, this is a tribute to their courage and training. In the noncombat situation, previous studies have shown that 90 percent of accident survivors are rescued within six hours.

Life support equipment frequently proved valuable, even for the aircrews who were captured immediately. Many used their radios while descending in their chutes to contact wingmen or rescue forces. Thus, even when no rescue was possible, the psychological boost of knowing that relatives would be notified of their safe escape from the aircraft was an important factor. Also, contact with wingmen or other aircraft during the descent denied the captors the probable psychological advantage of telling the POWs that no one knew where they were or that they were alive. Almost half of the returnees used their survival radios before capture. (This rate is understandably higher for successful evaders or noncombat ejectees—80 and 62 percent respectively.) One man summed up a rather general feeling:

"The survival radio is the most important piece of gear in this situation."

TABLE I

LIFE SUPPORT EQUIPMENT USED

Item	Number Who Used	Percent
Radio	101	48
PLB	46	22
Water	36	17
Knife	27	13
Weapon	11	5
Flashlight	10	5
Voice Attenuator	10	5
Survival Kit	15	7
First Aid Kit	15	7
MK-13 Flares	7	3
Pengun Flares	5	2
Signal Devices (Unspecified)	6	3
Strobe Light	4	2
Tracers	4	2
LPU	4	2
Raft	2	1
Go Pills	1	—

TABLE II

SURVIVAL PROBLEMS

Problem	Number Reporting	Percent Reporting
Incapacitated by Injury	44	21
Thirst	34	16
Topography	41	20
Communication	36	17
Darkness	31	15
Confused, Dazed, Disoriented	30	14
Rescue Vehicle/Personnel (None, delayed, shot down, limitations)	51	24
Weather	21	10
Fatigue	16	8
Enemy in Area	21	10
Lack of Survival Equipment	10	5
Exposure	10	5
Poor Physical Condition	9	4
Animals, Insects, etc.	7	3
Hunger	6	3
Survival Equipment Problems	4	2
Miscellaneous	3	1

Six returnees lost their radios and 18 of those who used radios experienced failures. Some of these failures were extremely critical.

"I lost all radio communication after one hour. Rescue would have been successful with a radio. The chopper was overhead."

"I was flying a rescue helicopter, and probably would have been picked up if I hadn't fallen on my radio and broke the damn thing."

"One radio battery was dead; the other lasted less than one hour. This cost me six and one-half years as a POW."

These incidents occurred in 1965 and 1966, before daily battery checks were instituted. Two individuals stated their radios were inadequate, and one expressed a need for a special transmitter:

"I needed a transmitter which could be hidden on a bare body, capable of sending signals, so my movements after capture could have been tracked."

Admittedly, this is a far-out request, especially since it is common practice to strip captives immediately after capture. Such a transmitter would have to be hidden within the body.

The personnel locator beacon was used by 22 percent of the POWs—nearly as frequently as among those who were recovered (27 percent) and more often than the noncombat group (14 percent). During part of the reporting period, beacons in some aircraft were not automatic.

Following radios and beacons, the most used item was water. Nearly all who were forced to leave their aircraft in Southeast Asia (SEA) expressed a profound need for water. Thirty-six of the returnees specifically mentioned using water prior to capture. Five others needed more water than they carried. One cut a banana tree and drank the water which collected in the stump—a procedure taught in the Jungle Survival School. Two reported losing their water flasks during ejection, and one flask failed.

Knives are probably the most classic of survival tools. They were used by 13 percent of the returnees and 10 percent of the successful evaders. Six returnees lost their knives, and one found his inadequate—he wanted a machete, a questionable request when silence and covert action are necessary to avoid capture. However, even small knives served well.

"I lost the leg of my 'G' suit due to violent ejection—with it went my MC-1 knife and flashlight. The small knife in the parachute was invaluable."

Another man was captured because of a problem with his knife.

"Couldn't unfasten straps on my survival kit. Couldn't cut them, because survival knife was tied to my harness with nylon, and I couldn't untie the knot. Couldn't cut the knot, because I lost my pocket knife on ejection. Finally, I forced the knife blade through the leather sheath, and was cutting the straps when I was surrounded."

First aid kits were next in order of usage—seven percent. (Compared to four percent for the successful evaders.) The same number of returnees, 15 (seven percent), reported opening and using items from their survival kits. The others got along with the items in their survival vests.

In previous studies it was reported that about five percent of the aircrews rescued in SEA used their sidearms. Interestingly, the same rate of usage applies to the returnees. However, two returnees expressed conflicting views of personal weapons:

"Rather than a large caliber sidearm which was a good signaling device but a poor survival weapon, aircrews should have a small caliber weapon with a

silencer and large clips of ammunition, such as a .22 with a silencer."

"I continue to have reservations about carrying a weapon. I was captured immediately — another American weapon for their arsenal."

Ten returnees reported using their flashlights. This was somewhat surprising in view of the need to remain hidden. However, in the deep blackness of a jungle night, some illumination is required for most tasks. Only two percent of the successful evaders reported using flashlights.

Signals have predominated among survival items in previous studies. For example, about half of the successful evaders in SEA reported using visual signals such as flares, strobe lights, mirrors, or tracers. In contrast, only 26 of the returnees said they used these signals. In most cases there was simply no one to signal, because they were in an area where rescue was impossible or there was no time. Only one man reported a signal failure—a pengun flare. Four individuals stated they needed visual signals and didn't have them.

A small percentage of the returnees reported needing items of equipment in addition to what they carried. However, there was no trend. Among the items mentioned were burn ointment, burn treatment instructions, rations, bandages, luminous button compass, morphine, machette, map, and a helmet radio jack. None of these items was reported as needed by more than one percent of the returnees responding to the questionnaire, even though this question was specifically asked. Evasion in the heart of a hostile country is a tough challenge. One returnee said the item he needed most was "vanishing cream." Another wanted wings. Still another expressed a more practical requirement:

"I was captured on the third day by a dog. Perhaps pepper in the survival kit would help when the enemy uses dogs."

One felt he was carrying too much equipment:

"I feel we were overloaded with equipment for this environment—to the point of being encumbered in the cockpit."

Such comments were definitely the exception rather than the rule, and most of the reporting returnees were very satisfied with their life support equipment.

Although water landings were quite rare, two individuals used their rafts, and four used life preservers. One of these made a pertinent observation:

"Recommend a method be devised for automatic actuation of LPU upon immersion in water. . . . I was rendered unconscious by the wind-blast from an excessively high-speed ejection. I remained unconscious for about 15 minutes. Had I landed in a nearby river, or any body of water, I would have drowned. How many did we lose in VN this way?"

The Air Force is actively developing an automatic life preserver.

Only five failures of flotation equipment were reported; however, two life rafts were lost during the ejection sequence and three failed to inflate when the kit was deployed.

The returnees experienced many survival/rescue problems in addition to their injuries. Thirty-four said they suffered from thirst, but only six reported acute hunger.

"I was weak and tired from no food—lost mental acuity. Many people around. If I'd been stronger I probably could have prevented their seeing me and continued to a safe area."

He'd been evading for four days.

One-fifth of the returnees stated the topography worked against them. Almost as many (17 percent) said they had communications problems. A high-speed ejection from a burning or disintegrating aircraft is a harrowing experience at best. When it happens over enemy territory, the physical and psychological pressures are enormous. Fourteen percent of the returnees said they were confused, dazed, or disoriented for varying periods after ejecting. Weather had an adverse effect on 10 percent, and five percent complained of exposure.

Fatigue or poor physical condition played a role in a few evasion attempts. Seven men had trouble with insects or animals.

Of course the enemy was the biggest factor in all these cases. Frequently the location of the parachute landing made the outcome of the evasion attempt a foregone conclusion. As one man wryly put it:

"Don't parachute into an enemy camp!"

In other cases injury was the deciding factor—and one returned pilot suggested:

"Don't get hurt."

Probably the best summation of all was simply, "WHEW!"

Although we normally think of life support or survival equipment as serving to get our crewmembers home as soon as possible after a catastrophic airborne emergency, the returnee reports show another facet. Even when the evasion attempt is unsuccessful, life support and survival equipment can help keep the crewman in the best possible shape to withstand the rigors of capture. In the case of the radio and other signals, it can also provide a great psychological boost during a most trying experience. The extreme consequences of even a small failure rate in life support or survival equipment are highlighted in a combat environment.

(Next month the inflight escape experiences of the POW returnees.) ★

OPS TOPICS

THREE STRIKES AND YOU'RE OUT!

An aero club of a sister service suffered a tragic and senseless accident recently. The pilot was observed performing aerobatics at extremely low altitude just before he crashed killing himself and his passenger. There were three strikes against the pilot.

1. Low altitude, unauthorized maneuvers.
2. Overconfidence.
3. Alcohol!

TALON TURNOFF



The student pilot executed a successful night full stop landing. During rollout he became distracted by the lights of an aircraft holding to cross the active. As a result, he attempted to turn off the runway at too high a speed and then took his Talon for a trip through the weeds.

FOUR ENGINE FLAMEOUT

The C-130 landed a bit hot and the IP in the right seat warned the pilot that the speed was too high for engine reversal. The pilot did not heed the warning and reversed the engines. All four immediately and simultaneously flamed out.

TOO MUCH JUICE



The T-37 was on an instrument training flight when the IP heard a loud hiss over interphone and observed the right loadmeter pegged. When he shut down the generator the loadmeter went to zero. After further investigation, the IP took the battery off the line as the checklist directs. Numerous light bulbs, the UHF radio, the main inverter and the nav equipment all failed. The crew recovered successfully to VMC and landed. The right voltage regulator had failed allowing an over voltage in the electrical system.

RIGHT IDEA WRONG TIME

A steely-eyed OV-10 jock rolled in on a dive bomb pass. As he pulled off, the range officer informed him that the rocket pod had departed the aircraft. Sure enough, the pilot had selected the wrong station with his armament switches.

HOT SHOT



After the C-130 crew shut down the engines, the nr 4 DC generator remained energized by the main DC bus. The crew could not switch the generator off the bus and the generator began to smoke. The crew accomplished the proper emergency procedures and exited the aircraft. The cause of the fire was a failure of the DC generator control panel which allowed the nr 4 generator to motorize and overheat.

NO CHUTE

When the F-4 pilot deployed the drag chute the Phantom didn't slow down, so he deployed the hook and engaged the departure end BAK-9. Seems that they forgot something. A drag chute was not installed, and the crew chief and pilot missed it on preflight.

OPS TOPICS

WRONG HANDLE

The IP showed the student the proper reference for level inverted flight in a T-38. After recovery, the student discovered that he had been holding onto the ejection seat handles and had raised them.

AERO CLUBS HONORED



Forty-three USAF Aero Clubs have earned FAA annual Flight Safety awards for a full year's accident free flying. Some of these clubs make a regular habit of this--one has received an award for six consecutive years. Well Done to you all.

TIRE FOD



Just as the T-38 rotated to takeoff attitude, the pilots heard a loud bang and felt the left wing drop slightly. Also, the left engine rpm decayed to 80 percent so the IP initiated an abort. The left main tire failed and threw pieces of rubber into the left intake causing a compressor stall (the tire had been checked on preflight and by the last chance inspectors).

URP!



The first ROTC orientation flight was without incident. After the T-38 engines were advanced to mil for the second takeoff, the right engine stalled. Inspection showed FOD damage to the compressor--most probably from an air sickness bag from the rear cockpit.

SEE THE LIGHT POLE

SEE THE SWEEPER

SEE THE STAND

- Two pilots of transport type airplanes recently learned that light poles and airplane wings don't mix. The two incidents cost over $30,000....
- The solo student in a T-37 successfully completed a NORDO recovery at home base. While he was taxiing in he struck an airfield sweeper with his right wing. At least 60 man-hours to repair the bird....
- The HH-53 was being marshaled to parking when the blade tips struck a maintenance stand. The shrapnel from the contact seriously injured the marshaler....

In each case the pilots forgot the cardinal rule of taxiing. If you are not sure of your clearance, DON'T GUESS, CHECK IT!

FLU BUG



Shortly after takeoff, the fighter pilot felt warm with tingling sensations in his arms and legs. Since these were his hypoxia symptoms, he made an emergency landing. The flight surgeon diagnosed the cause as an intestinal viral infection.

ASR APPROACH CRITERIA

How far is too far? It may be farther than you think. Most pilots are aware of the 500-ft at 1 mile criteria for aircraft position on an ASR. But, the actual allowable error is 500 feet or 3 percent of the distance between the missed approach point and the radar antenna, whichever is greater. For more information see change 2 to AFM 51-37.



Each year the Instrument Flight Center reviews past "IFC Approach" articles for currency. Articles considered current are those published after December 1971 excluding the following articles or topics:

DELETE

1972 April
1973 September
1974 June

CORRECT

June 1972, "What's in a Name," delete last paragraph.

April 1973, delete figure 3.

January 1974, delete "ARTS III."

March 1974, delete the last sentence of the note in the answer to the third question.

May 1974, delete the last question and answer.

August 1974, delete the second question and answer.

Previous deletions and corrections published for these articles are still in effect. The USAF Instrument Flight Center has a limited number of the "IFC Approach" booklets available. We encourage the users of these articles to locally reproduce them from AEROSPACE SAFETY magazine.

HELICOPTER PILOTS

An all-weather mission capability for helicopters is becoming a requirement. Special procedures and equipment continue to be developed to assist the chopper pilot while he is flying in IMC. Here are a few points to ponder.

Q How is a "helicopter only" approach titled?

A Helicopter only procedures bear an identification which includes the term "COPTER," the type of facility providing final approach course guidance, and a numerical identification of final approach course; e.g., COPTER VOR 093, COPTER TACAN 327. If the procedure includes an arc final approach, the word "ARC" will be used and will be followed by a sequential number; e.g., COPTER VORTAC ARC 1, COPTER TACAN ARC 2.

Q What is the maximum approach and holding airspeed for "COPTER only" instrument approaches?

A The maximum airspeed is 90 knots IAS. This is published in FLIP, Section I, under aircraft categories and also in Section II, under holding procedures.

Q I recently flew my first "COPTER only" approach. I departed the IAF, using a rate of descent of 500 feet per minute, and arrived at the final approach fix well above the recommended altitude. What happened?

A According to AFM 55-9 (TERPs), the *optimum* descent gradient for all segments of a helicopter approach is 400 feet per mile. However, if a higher descent gradient is necessary, the gradient may be increased to as much as 600 feet per mile. If this is the case and assuming your groundspeed was 90 knots, you would require a descent rate of 900 feet per minute. If an operational requirement exists, a descent gradient of as much as 800 feet per mile may be authorized, provided the gradient used is depicted on the approach chart.

Q If I depart an airfield on a special VFR clearance, am I assured another special VFR clearance to return immediately to the airfield in the event I abort my flight?

A No; tower must coordinate your return clearance with approach control. If your return would conflict with arriving or departing IFC traffic or other special VFR traffic, you may not receive a special VFR clearance to return until that traffic is not a factor.

Q Can I as a helicopter pilot fly the fixed wing rectangular traffic pattern at my base?

A Yes; if your helicopter can fly at an airspeed compatible with fixed wing aircraft flying the rectangular pattern. This was recently incorporated into AFR 60-16. ★

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"CLEARED FOR A VISUAL APPROACH"



JAMES D. LANG, Federal Aviation Administration, Directorate of Aerospace Safety

From FAA Handbook 7110.8C, Chapter 1, Section 3, Paragraph 23 — DEFINITIONS:

Visual Approach: An Approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of a radar facility and having an air traffic control authorization, may deviate from the prescribed instrument approach procedure and proceed to the airport of destination, served by an operational control tower, by visual reference to the surface.

Visual Separation: A means of separating IFR, FW/SIFR, SVFR and, where special programs are in effect, VFR aircraft in terminal areas wherein either of the following methods is applied:

a. The tower controller sees the aircraft involved and issues information and instructions, as necessary, to ensure that the aircraft avoid each other.

b. A pilot sees the other aircraft involved and upon instructions from the controller provides his own separation by maneuvering his aircraft as necessary to avoid it. . . . A pilot's acceptance of traffic information and instructions to follow another aircraft or provide visual separation from it is considered to constitute acknowledgement that he sees the other aircraft and will avoid it....

So what is this "visual" business all about, when it comes to controlling IFR traffic? The practical aspect is that no matter what your circumstances may have been in the enroute environment, you may have to contend with a concentration of VFR traffic if the conditions in the terminal area are at or above VFR minima REGARDLESS of your type of flight plan. By a nearly direct vector to the traffic pattern, instead of a lengthy one to a GCA gate or the ILS localizer, you have less exposure to the VFR traffic. Assuming an extensive VFR traffic situation, the less maneuvering you do in a mix with it, the less your chance of potential problems associated with it. Another very important consideration is that, by using less time in processing an IFR ar-

rival, the IFR acceptance rate of the airport is proportionally increased.

How does it work in practice?

Let's say you are IFR into a busy terminal complex. Weather is severe clear. Center hands you off to Approach Control. Comes the reassuring "RADAR CONTACT" and the numbers. Next thing you hear from Approach is: "AIR FORCE ONE-TWO-THREE, THIS WILL BE A RADAR VECTOR TO THE TRAFFIC PATTERN FOR A VISUAL APPROACH. TURN TO HEADING SO-AND-SO. MAINTAIN SO-AND-SO. REPORT FIELD IN SIGHT." Minutes later you hear the same transmission to Air Force Four-Five-Six.

What have you got now? The weather is VFR, remember? Busy terminal area, remember? Probable heavy VFR traffic, remember? There is another IFR aircraft being set-up for a visual approach to the same runway, remember?

Here's what you've got for sure. Full standard separation from all other IFR traffic, including the other one running a visual approach to the same airport as you. *That's all!* It is precisely the same thing you would have were you executing a complete TACAN, ILS or GCA approach.

What should you expect from here on?

First you may rest assured that Air Force Four-Five-Six will be separated from you by IFR standards, i.e., either 3 miles laterally by radar or 1000 feet vertically. You may expect radar traffic information on VFR traffic in your line of flight but you will not be vectored (nor will the VFR) for separation purposes, unless you specifically request it. Air Force Four-Five-Six is receiving precisely the same service as you. In your case, as well as that of Four-Five-Six, visual separation as an IFR principle is NOT being applied in calling the VFR traffic. Remember: one authorized radar traffic information advisory to alert you to VFR traffic is: "NUMEROUS TARGETS VICINITY OF SO-AND-SO."

Remember above all that the hemispherical altitude rule for VFR traffic is NOT applicable below 3000 feet AGL.

Say you pick up the field at 10 to 12 miles and so inform approach. Next thing you'll get is: "AIR FORCE ONE-TWO-THREE —CLEARED FOR VISUAL APPROACH TO RUNWAY SO-AND-SO." This busts any altitude assignments you have and permits descent to appropriate traffic pattern altitude. No more vectors! No more altitude assignments! The only thing you'll get from Approach now is traffic information until you are instructed to contact the tower.

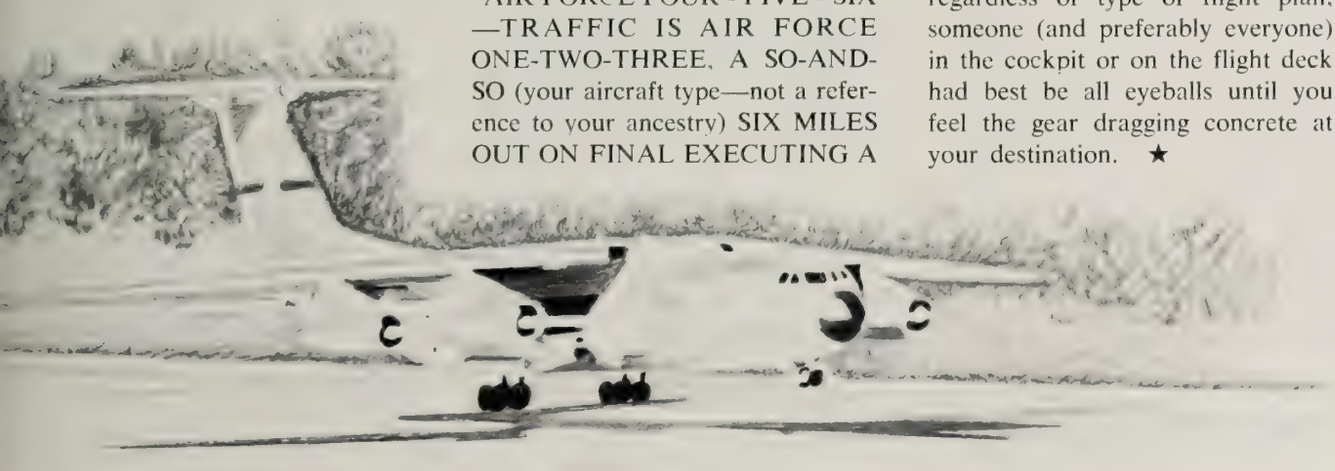
You hear Four-Five-Six report that he has the field in sight. Instead of a clearance for a visual approach you hear Approach issue him a vector and or an altitude hooker. Why? He is being vectored or held at a firm altitude to preserve standard IFR separation from you. At the same time he is being positioned to make a visual sighting on you. Sorta like a GCI—right?

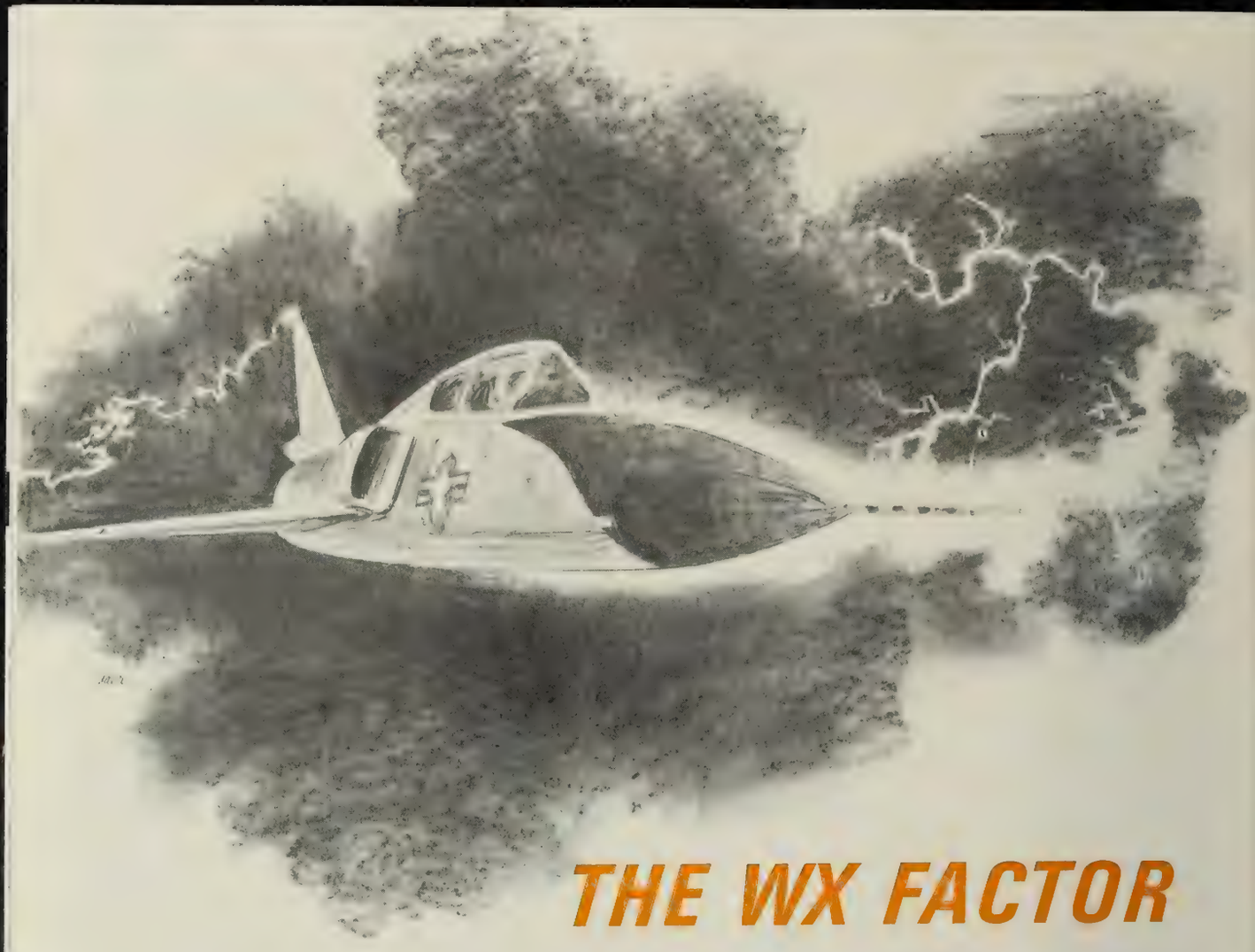
You are now lined-up six or seven miles out. You hear Approach saying to Four-Five-Six something like: "AIR FORCE FOUR - FIVE - SIX —TRAFFIC IS AIR FORCE ONE-TWO-THREE, A SO-AND-SO (your aircraft type—not a reference to your ancestry) SIX MILES OUT ON FINAL EXECUTING A VISUAL APPROACH FOR RUNWAY SO - AND - SO. DO YOU HAVE HIM IN SIGHT?" From Air Force Four-Five-Six you hear: "AFFIRMATIVE — I'VE GOT HIM." Now from Approach you hear: "AIR FORCE FOUR-FIVE-SIX—CLEARED FOR VISUAL APPROACH TO RUNWAY SO-AND-SO. FOLLOW AIR FORCE ONE - TWO - THREE." Air Force Four-Five-Six rogers for the clearance. At this point Visual Separation as an IFR principle IS being applied.

Next, Approach will direct both of you to contact the tower. Their job of *approach sequencing* is completed. Tower will then sequence you for *landing* with the VFR traffic in the pattern.

Remember from the definition of Visual Separation that, in accepting the traffic information and instructions to follow you, Air Force Four-Five-Six, has accepted a responsibility in relation to you. He must maneuver his aircraft so as to avoid you.

So what does all this mean? It means that by utilizing visual approaches and visual separation, the system can move more IFR traffic per unit of time without compromising the IFR status of those aircraft on IFR flight plans. It bears out the fact that, the IFR VFR mix in terminal areas is still a factor that has to be reckoned with. It points out most dramatically that the mere existence of an IFR flight plan does not provide an envelope of exclusive airspace for the IFR flight in VFR conditions. It means above all that, when operating in VFR conditions regardless of type of flight plan, someone (and preferably everyone) in the cockpit or on the flight deck had best be all eyeballs until you feel the gear dragging concrete at your destination. ★





THE WX FACTOR

LT COL GEORGE E. CHAPMAN
Hq Air Weather Service

Penetrated clouds at FL 200 with radar painting isolated thunderstorm cells in vicinity of flight path. Shortly after beginning an instrument approach, a loud bang accompanied by a bright flash occurred. Resumed normal flight path and effected landing without further incident. Post flight check revealed hole burned in center of radome assembly with additional burn marks on leading edge of right wing near wing-tip.

Cause: lightning strike. Estimated dollar loss: $7,450.

Sound familiar? It's quite possible, since the hypothetical incident report cited above is but one example of a growing list of weather factor aircraft mishaps being experienced throughout the Air Force. Despite the trend toward an all-weather flying force, figures available for the past few years, depicted in figure 1, have shown a steady increase in the number of weather factor aircraft mishaps. Measured in terms of hardware loss, the associated dollar value in 1972 was nearly $20 million.

To put the facts and terminology in proper perspective, the term weather factor aircraft mishap refers to those encounters which destroy, render inoperative, or damage an aerospace vehicle to the extent that a reportable mishap results.

The weather factors responsible for the majority of these mishaps are listed in table 1. Clearly lightning-caused mishaps are creating the biggest problem. In fact, in all but one of the years, lightning strikes exceeded all of the other weather factors combined. If we group the factors into a family of weather problems, it is clearly convective activity—a thunderstorm related phenomenon—that breeds the problems. This point is shown rather well in figure 2. The activity index is the number of severe thunderstorms observed at locations for which the USAF Weather Service has point warning responsibility. Clearly the seasonal variation and annual increase in severe

convective activity is closely correlated with the number of weather factor mishaps.

Obviously, you would expect the greatest impact to be experienced by those aircraft whose normal operating altitudes near the freezing level expose them most frequently to these weather hazards. Table 2 confirms this belief. The C-130 bears the brunt of these problems.

OK, to this point, you probably haven't read anything new. Thunderstorms, in general, and lightning strikes in particular, are a big problem and you try to avoid them. But with the mishap rate continuing to climb, and 1974 figures-to-date indicate it is not tapering off, it's appropriate to examine the big problem, lightning, and see what we can do about it, both as pilots and weathermen.

First a little background on the causes of aircraft lightning strikes and where you can expect them to occur. Aircraft triggering of lightning is a relatively common event. The charge an aircraft can attain is caused by the impact of particles ranging from haze and tiny ice crystals to large rain drops. The larger the aircraft and the faster it flies, the more particles it will impact, generating a higher charge. If the cloud is fairly active electrically, even though not producing natural lightning, then the entry of even smaller aircraft into the cloud can trigger a strike.

Configuration of the high curvature points on the airframe is also an important factor. Model studies conducted on the B-1 to determine the probability of strikes to various parts of the aircraft indicated that 90% of the strike points involved the nose pitot boom, the wing tips, and the vertical and horizontal stabilizer tips.

Tests of the USAF Weather Service's lightning warning system at Kelly AFB produced some interesting results. The tests indicated that the largest electrical charges exist before any discharge mechanism is set up within the cloud itself. In other words the biggest problem may exist before the pilot sees the visible discharge of lightning. This type of situation presents a particular problem to large aircraft, such as the C-5 and B-52, or formations of small aircraft during takeoff, landing, and low altitude cruise through heavier rainshowers.

A recent project conducted by General Electric in cooperation with five major airlines determined that 95% of all lightning strikes occur below 22,000 feet, with the most critical area being near the freezing level where the charge buildup is the strongest.

Going from the cause to the effect, there are a number of ways in which the problem of lightning impairs the safety of flight without causing total failure of the entire system.

The most obvious effects are pitting or puncture points where lightning enters or leaves an aircraft. Normally, there will be two or more attachment points; one or more where lightning enters or first strikes the aircraft and another where it leaves. The radomes are particularly susceptible to lightning strike damage, causing a loss of radar capability when it is needed the most.

The increasing use of composite materials such as boron-epoxy and graphite-epoxy in structural design has also posed a problem. Lightning tests of these materials show them to be neither good conductors nor good insulators, nor very good in providing shielding against electromagnetic radiation. If these materials are used in locations where they may be struck by lightning, some form of light-

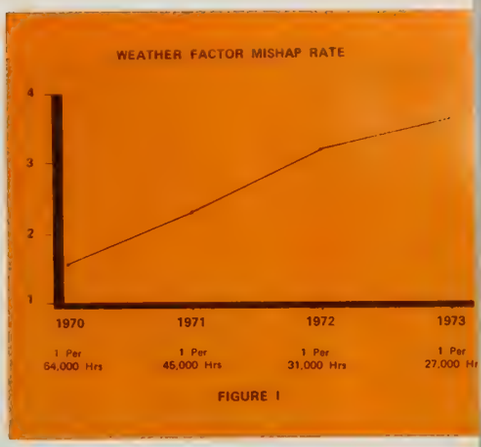


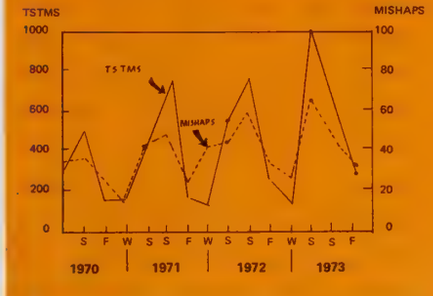
FIGURE I

TABLE I
CAUSES

	1970	1971	1972	19
LIGHTNING	66	86	75	10
ICING	4	2	27	9
TURBULENCE	6	3	22	9
HAIL	12	14	14	18
SURFACE WIND	5	9	11	6
RAIN	3	3	8	4
OTHER	7	11	8	11
TOTAL	103	128	165	158

FIGURE II

ACTIVITY INDEX

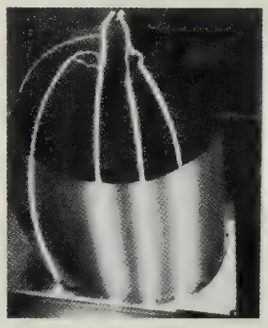


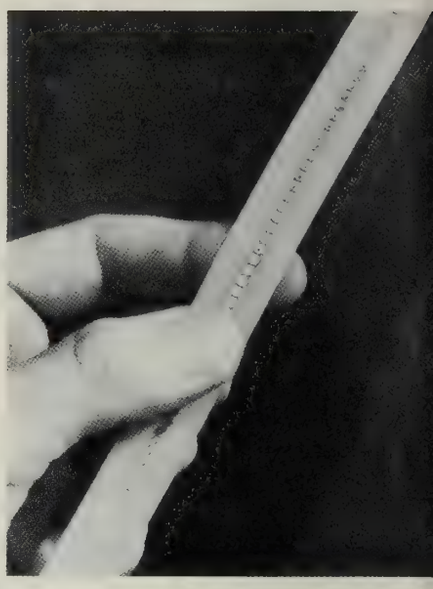
USAF AIRCRAFT

	1971	1972	1973
B-52	3	19	6
C-5	–	3	2
C-9	–	2	6
C-130	29	21	39
C-135	6	13	5
C-141	11	11	9
F-4	21	21	15
F/B-111	5	20	19
T-39	3	4	7

TABLE II







Segmented diverter strip offers protection from lightning strike with negligible effect on RF pattern characteristics. Protection capability of diverter strip is shown in small photo above.

ning protection will be required to protect the structure and any system they enclose. Should a lightning pulse enter the electrical system, malfunction or loss of instrumentation could result and in the worst case a lightning pulse may arc into the fuel probe signal line, enter a fuel tank, and cause a catastrophic explosion.

Lightning currents can be channeled into conducting media resulting in increased current densities which produce strong electromagnetic fields. These currents and fields interact with the electrical circuits and structural members to produce heating in resistive materials and deformation or damage to structural material.

The more modernized avionics systems have resulted in both blessings and problems. The main problem is that modern electronics are much less tolerant of transient voltage and current surges than were vacuum tubes and large electronic components of older aircraft. Projected avionics systems which will make use of the newer solid state devices may be more susceptible to failure of the system due to a lightning strike. Engineering solutions will be particularly helpful in this area.

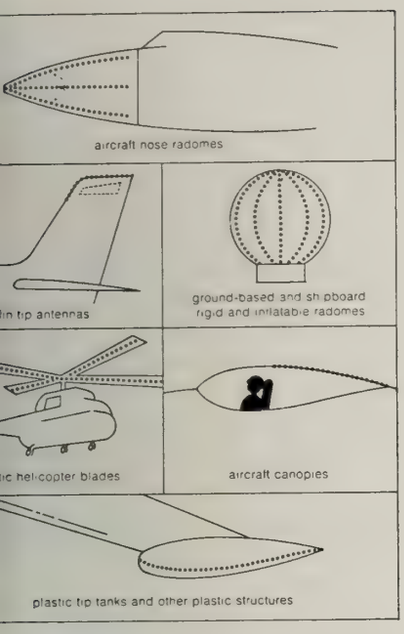
One of the more vexing problems that confronts the pilot from time to time results from the reduced flexibility inherent in computerized traffic control systems. In high density flight patterns the aircraft is often forced along a path where the risk of lightning strike is much higher and from which deviation is discouraged, if not prohibited.

So much for the problem. Now what can be done to begin turning this mishap rate around? As a starter, additional flying procedures can still be undertaken to reduce the probability of a strike: avoid areas of heavy precipitation and heavy cirrus; remain in the vicinity of the freezing level only a short time through steeper climbs; consider the mass triggering effect of formations of aircraft; decrease speed in high potential areas; use St Elmo's fire as an indicator; and possibly further increase distance from thunderstorms and heavy rain showers.

Many of the dash ones are short on information concerning lightning effects on their specific aircraft and could stand an update. Many show only a brief note requiring thunderstorm lights to be turned on to avoid the blinding effects of a lightning flash.

Much can be done through flying safety meetings to raise the level of aircrew awareness on all facets of the lightning problem. The local USAF weather detachment can provide you with assistance in this regard.

In the area of future research, the Air Force Cambridge Research Laboratory (AFCRL) has been con-



Some applications of diverter strip for lightning strike protection are shown above.

ducting R&D of on-board lightning warning sensors for many years. Their main thrust at this time is toward the miniaturization of a sensor to fit into high performance aircraft. This sensor will enable the pilot to avoid lightning activity and strong electric fields. Sensors will give an indication of the electric field to the left, right, above, and below the aircraft. CRL believes that such a system will be of particular value in high altitude weather reconnaissance aircraft to determine which portions of extensive undercast skies contain convective cloud activity or residual electrical charge concentrations from previous storms.

For some aircraft, a cost-effective solution to radome damage may be the placement of an aluminum strip on the radome to channel the strike into the conductive skin. Minor damage may still occur to the skin of the aircraft, but the radome would remain functional. An even better solution, perhaps, would be the use of the button diverter which provides less radar interference.

In the ground environment, the lightning warning set will be used for warnings of developing, potentially hazardous electrical activity within a 40 mile radius of the runway complex. A prototype set tested and evaluated at Kelly AFB in 1972 provided 10 to 15 minute lead time before onset of local lightning activity, in the great majority of cases. Not only will the set enhance safety by providing necessary warning, it can reduce such things as refueling down time through the elimination of non-justified warnings. Twenty-eight locations have been identified, world wide, where these sets will be used to enhance operational effectiveness.

In short, the weather factor aircraft mishap problem shows signs of becoming a problem of major proportions. However, through pilot awareness of potential problem areas and continued cooperative endeavors of the meteorologist and engineer, we are looking to turn the curve depicted in figure 1 downward and make the descent or penetration in the vicinity of a thunderstorm a little safer. ★

Col Chapman has held a variety of jobs within Air Weather Service including detachment weather forecaster, satellite meteorologist with NASA, staff meteorologist to R&D activites in AFSC, command of a unit in Vietnam, and currently Director, Operational Evaluation, Headquarters Air Weather Service. Col Chapman has a BS in Meteorology from Texas A&M and an MS degree from Massachusetts Institute of Technology.

TECH TOPICS

FOOD



We have so much FOD that I'm getting snakebit. In fact, lately when I see the word FOOD I think it means foreign objects overdone. Take f'rinstance a pair of pliers. Would you believe the Air Force (that's you and me, taxpayers) paid $256,870 for a pair of duckbill pliers? It (we) did. Crazy, huh! Seems that someone left them in the engine bay of an F-111E, with catastrophic results. Not only was an engine overhaul required, but another 300 manhours were needed for repair of other damage.

* * * * *

Oil sampling has been a big help in detecting impending engine failures. May it continue to be, but there are times when . . . well, read on. A T-39 crew had to RTB after oil pressure dropped to 5 psi and the warning light came on. Maintenance found a piece of plastic oil sampling tube, 15 inches long, blocking the oil tank outlet. In another case, this time an A-37B, a plastic cap off an oil sample tube was found in the oil tank screen.

* * * * *

Number six engine on a B-52 was being run to ops check the bleed valve governor. After approximately 30 minutes of run time, the ground observer detected something wrong and the engine was shut down.

Inspection revealed that a screwdriver left in the oil cooler housing had found its way into the engine intake causing major damage to the compressor.

milk of magnesia is a good lubricant only if...



In the October 1967 issue of **Jet Service News** there was an article about the dangers of using flavored milk of magnesia for lubricating electrical connectors. Because Change 9 of T.O. 2J-J85-66-1 specifies the use of milk of magnesia for lubricating some threaded parts of hot section components, GE has updated the article to reflect this fact. The article is reprinted below as a reminder that only unflavored milk of magnesia is allowed as a lubricant for engine parts.

Just a spoonful of sugar may help the medicine go down, but it doesn't help the "medicine" when it's used as a jet engine lubricant. Magnesium hydroxide, commonly known as milk of magnesia, has been found to be a highly successful lubricant on such jet engine parts as electrical connectors and hot section fittings.

For some time now our technical manuals have authorized its use for specific applications. However, since these applications are not in accordance with the primary design intent of milk of magnesia, its manufacturers have added such delicacies as chocolate and peppermint syrups to their products. The syrups apparently have no adverse effect on the therapeutic value of the product, but they sure make a mess when used as a jet engine lubricant. We've had reports of just this happening when a well-meaning mechanic went down to his corner drugstore to replenish his supply of milk of magnesia and neglected to specify that it should be unflavored.

The correct prescription for milk of magnesia for lubricating engine parts is:

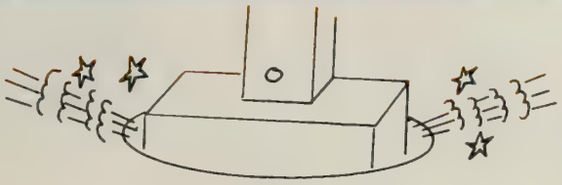
Milk of magnesia—Class A, commercial, unflavored; 7 to 8 percent, by weight, $Mg(OH)_2$; the remainder water. The best way to be sure of getting this is to order it through your supply system, using FSN 6505-243-4954. **—Jet Service News**

lost pylon

Upon entering the range, the F-4E pilot set up the weapons switches for a 10 degree low level run. When the delivery parameters were reached, the pilot depressed the bomb pickle button and the SUU-21 (left outboard pylon) departed the aircraft. All switches were rechecked for proper position and then safed, and the aircraft returned to base.

Fourteen days prior to this incident, during a local exercise the TERs were loaded and cartridges installed. After the exercise the TERs were down loaded. Apparently the cartridges were not removed and the installed carts not detected during wiring and sealing of cartridge breeches.

wrong part



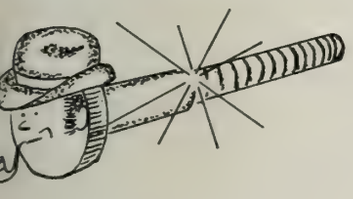
During FCF following Programmed Depot Maintenance (PDM), check of the landing gear system was performed IAW TO 1C-135(K)A-6CF-1, and all checks appeared normal. After the aircraft landed, the left aft outboard main gear door assembly was found to be damaged. A review of the records showed that during PDM the left main gear oleo door was discovered to be cracked. A replacement door was ordered, received and installed on the aircraft. However, this replacement door was actually a commercial part used on Boeing 720 aircraft, and not a suitable substitute for the KC-135. The container was labeled with the correct part and stock number for the required item.

A check of the part number attached to the door once it was removed from the container would have revealed this error.

headset gobblers

A three man crew was trim running an F-111. The team supervisor was in the cockpit, one man was on the headset on the ground and the third man was in the trim trailer. Shortly after coming out of AB and while at mil power, the fuel low level warning horn sounded on the -60. The man on headset on the ground turned to look toward the -60 and his headset was pulled off and ingested into number two engine through the blow in door. Considering the number of headsets that have been lost to jet engines, it seems some sort of restraining device would be in order. This unit is considering the addition of a nape strap, or a fence to be placed around the inlet/blow in doors during engine run.

murphy bolt



Immediately after liftoff during a max effort takeoff, the C-130's elevator control stuck in the aft position. Extreme forward pressure was required by both pilot and copilot to break the controls loose. An emergency was declared and the aircraft returned to base.

Maintenance investigation revealed that a bolt had been installed backwards in the tension regulator mount on the copilot's elevator control. The reversed bolt had come in contact with the cockpit floor causing the control to hang up.

B-nut again

The left engine of a T-38 was being run on the trim pad for rpm and egt fluctuation. After seven minutes at military power, the throttles were placed in afterburner range with no resulting ignition. The throttles were retarded to military for one minute and then returned to afterburner. The left engine fire warning light immediately came on, and the ground observer called "fire in the left rear fuselage area." The engine was shut down and the cockpit operator immediately deplaned; however, by this time the ground observer had extinguished the fire.

The afterburner drain valve line B-nut had backed off, allowing fuel to spray into the engine bay and be ignited by the hot engine. Proper torque of the B-nut during installation would have prevented the near disaster.

sharp troops



Some sharp maintenance troops discovered a blue lint type material in the fuel cart filter after defueling a KC-135. The material was on the upstream side of the filter, indicating it came from the aircraft that had just been defueled. Maintenance personnel inspected the fuel filters on all four engines and the same lint material was found. The aircraft was placed in fuel cell maintenance for a complete cell inspection. This inspection revealed a blue rag lodged in the aft body forward air refueling pump. ★

mail call

SIMULATION

The article in the October issue of the Aerospace Safety Magazine written by Capt Jerome T. Bellen regarding simulation was generally very well done. In a relatively short article it presented a very good summary of what is happening in the world of simulation and Instructional System Development.

There is one erroneous impression that may have been left by the article, however. The dialogue between the pilot and the WSO that leads into the description of the Simulator for Air-to-Air Combat would leave one to believe that the rear seat has a visual display as well as the front seat. Unfortunately the wrap-around CRT's do not include the WSO. This is a serious training shortcoming that hopefully will be solved by follow-on air-to-air simulators.

A couple of other minor discrepancies: The A-7D simulator, while being one of our better simulators, cannot be classed as a full mission simulator. Due to the lack of a visual display, many tasks performed by the A-7D aircraft cannot be accomplished in the simulator. Also, the A-7D simulator has only four "degrees" of motion, not six. Lastly, the SAAC consists of two F-4D cockpits, not two F-4E cockpits.

I sincerely hope the letter is not construed as nit-picking. The article was greatly appreciated by one who is definitely a simulator advocate. I am currently assigned to Hq USAF in the Instructional Systems Division in the Directorate of Operations. A major area of my responsibilities is involved with providing cost-effective aircrew trainers.

It is encouraging to see information regarding the positive aspects of simulation published in a magazine with your following. It should go a long way in dispelling the negative feelings many Air Force pilots have about flight simulators.

Sincerely

THOMAS A. RUSH, Lt Col, USAF
Instructional Systems Division
Hq USAF, Pentagon

NEW FLIP PLANNING

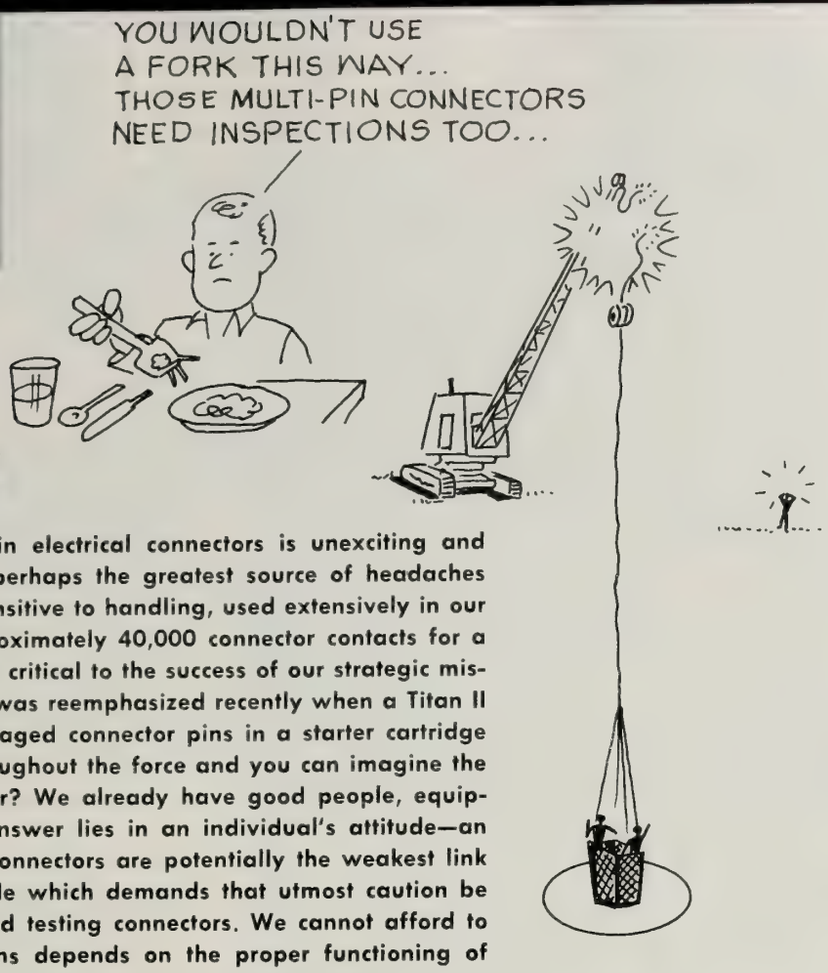
There is a new FLIP Planning coming. It's better, simpler, neater and it will be much easier to use, mainly because it eliminates duplication and because it is functionally arranged into two parts: General Planning (GP) and Area Planning (AP).

THE GENERAL PLANNING BOOK contains general information on all FLIPs, explanation of the Divisions of The Airspace, Meteorological Data, Time Signal Information, Terms and abbreviations, and Worldwide Conversion Tables. Much of the information duplicated in each of the current operational Section IIs has been transferred to this one Section. This includes information on Flight Plans and Pilot Procedures that has common, worldwide application. In addition, information pertaining to ICAO Procedures has been transferred to this Section, eliminating the present Section III.

THE AREA PLANNING BOOKS contain Planning and Procedural Data for a specific geographic area of the world. They are divided into Theatre, Regional and National Procedures, in which information pertaining to any particular country that differs in any aspect from standard ICAO procedures is shown by exception only. The current Section IIA and B remain relatively unchanged except for titling and chapter format. The new titles are listed below:

General Planning
North and South America Area Planning AP/1
North and South America Area Planning AP/1A Special Use Air Space
North and South America Area Planning AP/1B U.S. Military Training Routes
Europe-Africa-Middle East Area Planning AP/2
Europe-Africa-Middle East Area Planning AP/2A Special Use Airspace
Pacific-Australasia-Antarctica Area Planning AP/3
Pacific-Australasia-Antarctica Area Planning AP/3A, Special Use Airspace ★

MISSILE TOPICS



A MATTER OF ATTITUDE

No doubt the subject of multi-pin electrical connectors is unexciting and much worked. Yet these devices are perhaps the greatest source of headaches for the missile force. Connectors are sensitive to handling, used extensively in our systems (a "gee whiz" figure of approximately 40,000 connector contacts for a single Minuteman Launch Facility), and critical to the success of our strategic missiles, space boosters and probes. This was reemphasized recently when a Titan II launch was aborted due to three damaged connector pins in a starter cartridge connector. Spread this type failure throughout the force and you can imagine the ramifications. What then is the answer? We already have good people, equipment, and tech orders. Perhaps the answer lies in an individual's attitude—an attitude which should recognize that connectors are potentially the weakest link in any missile system; also, an attitude which demands that utmost caution be exercised when inspecting, mating, and testing connectors. We cannot afford to forget that the success of our missions depends on the proper functioning of these critical components.

IT'S A LONG WAY DOWN

At a missile site two men being hoisted by a crane were dropped and killed when the cable broke. The crane was not equipped with an anti two-blocking device and the operator was inexperienced—a fatal combination.

Some months later a crane operator working at a different site on the same base was asked to demonstrate the anti two-blocking device on his equipment. The device failed to work. Once again, at a missile site on another base a crane operator was asked to test the anti two-blocking device on his crane. It too failed to work.

What is an anti two-blocking device? Generally, it's a system designed to automatically shut down the crane when the hoisting block comes close to the sheave installed at the boom point. Without such a device in good working order, an inattentive operator might allow the two to come together while the crane is in operation, subjecting the cable to breaking tension—exactly what happened to the two men mentioned above.

When an anti two-blocking system is installed, it certainly should work properly, but as you see we haven't reached that level of assurance yet. So a word of caution to the men who are asked to ride a crane bucket—before you get in, be sure that the crane is in good working order.

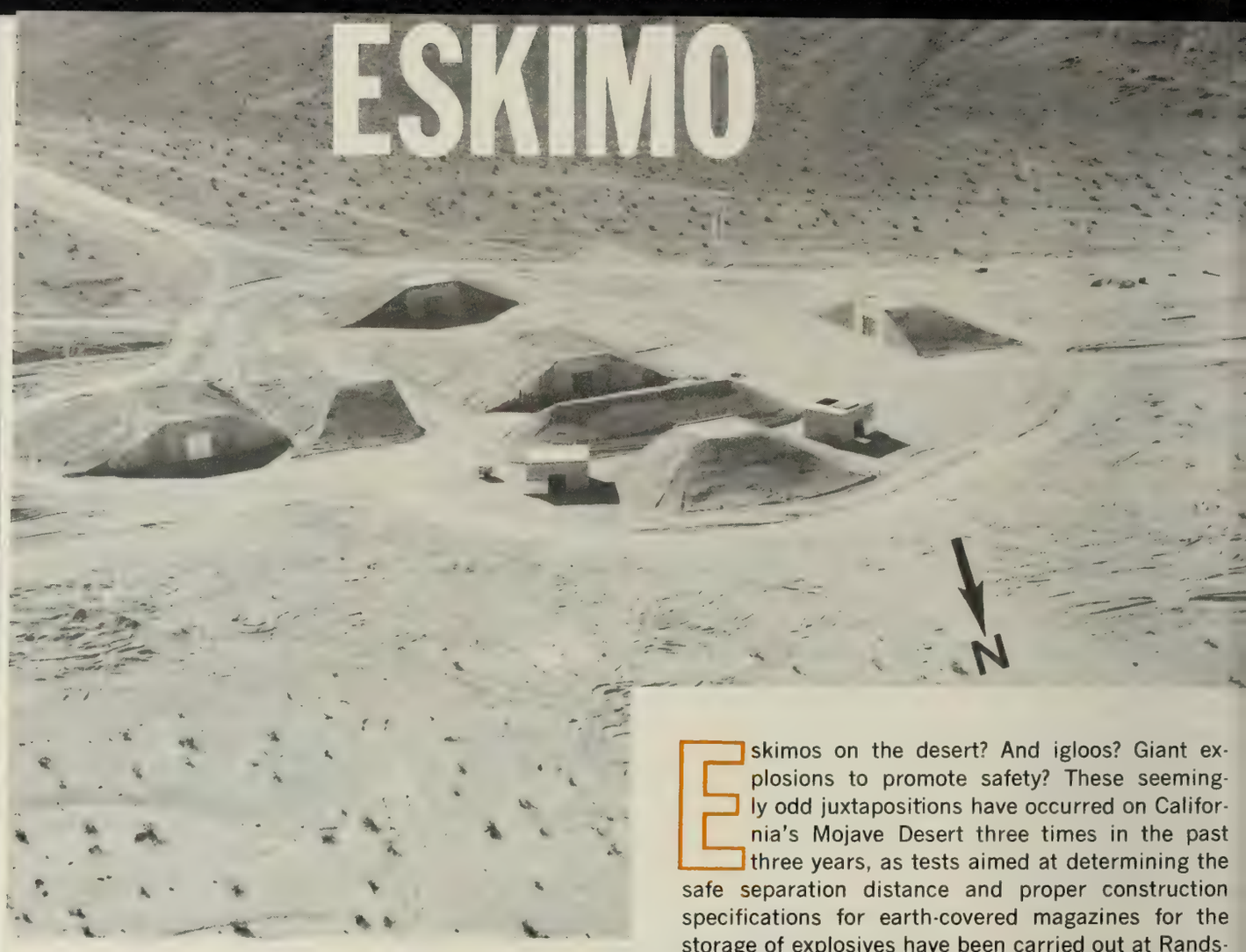
LEST WE FORGET

Ten years ago, a Titan II hydraulic motor blew apart while opening the silo closure door. The cause was improper installation of hydraulic valves.

Five years ago no reportable accidents or incidents occurred.

One year ago, three power supply drawers were damaged and valuable alert time was lost when a missile maintenance team failed to ensure the emergency fan key switch was in the "ON" position prior to departing a Minuteman launch facility. ★

ESKIMO



CAPTAIN P. F. KLEIN, USN
Chairman, Department of Defense Explosive Safety Board
and E. F. WEALS
Naval Weapons Center
China Lake, California

Eskimos on the desert? And igloos? Giant explosions to promote safety? These seemingly odd juxtapositions have occurred on California's Mojave Desert three times in the past three years, as tests aimed at determining the safe separation distance and proper construction specifications for earth-covered magazines for the storage of explosives have been carried out at Randsburg Wash Test Range on the Naval Weapons Center (NWC).

The sponsor of these magazine separation tests, the Department of Defense Explosives Safety Board (DDESB), has devised the acronym ESKIMO for the test series—a natural association with igloos, or earth-covered magazines, but also a useful shorthand for Explosive Safety Knowledge IMprovement Operation. The operation is part of a continuing Explosives Safety Board program to determine more accurately, among other things, minimum safe separation distances between magazines storing explosives. These distances are the least that will provide assurance that an explosion in one magazine (the donor) will not propagate to another (the acceptor), although the acceptor magazine, and possibly its contents, might be extensively damaged.

SAVING LIVES AND REAL ESTATE

In the early 1960s, motivated by the desire to recommend procedures that would save on real estate and construction costs as well as increase confidence in the safety with which explosives were being stored, the Board requested that NWC conduct a series of six magazine separation tests. As a result of these

tests, a new standard steel arch magazine was approved; the minimum safe spacing between the side walls of adjacent earth-covered magazines was redefined; a decreased spacing between the rear walls of magazines situated back-to-back was shown to be safe; and spacings for other siting relationships were confirmed.

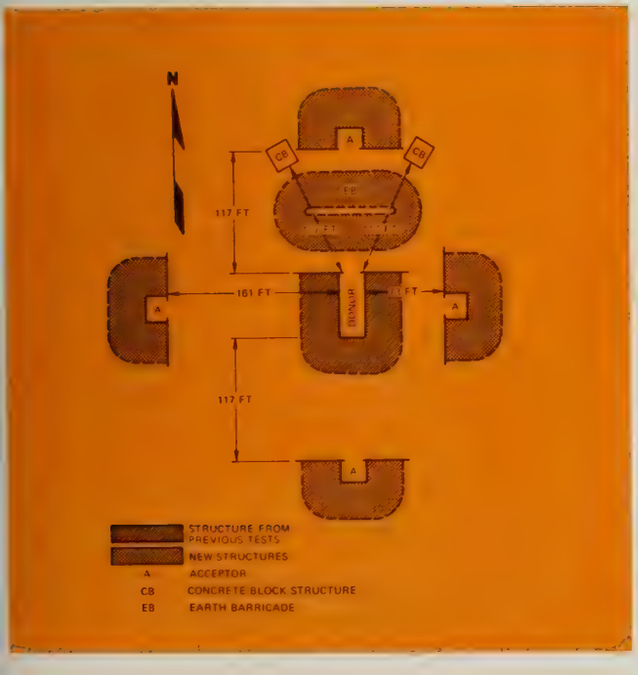
These tests showed that previous DDESB side-by-side and back-to-back spacing criteria had been unnecessarily conservative. Perhaps other criteria could also be reevaluated. Little information had been developed to indicate the minimum safe distance between the concrete headwall of a magazine and the earth-covered side, rear wall, or barricaded headwall of another magazine. Increasing land values and siting problems made it desirable to evaluate magazine separation standards further.

PREPARATION FOR ESKIMO I

In the summer of 1971, preparations began for the first of the ESKIMO series of tests. NWC's Randsburg Wash Test Range was selected as the test site. A barren, unpopulated area, this site provided the perfect location for a potentially dangerous activity.

Four steel-arch, earth-covered storage igloos of corrugated structural plate were built on the site, in accordance with accepted magazine construction specifications. A very slightly damaged igloo left over from a 1963 test was to be used as the donor. Two concrete block structures were also placed on the site, north of the donor. An uncompacted earth barricade was placed between the donor and the north acceptor structures. The layout of test structures is

FIG. 1





shown in Figure 1; the spacing distances shown were chosen to test formulas based on multiples of the cube root of the explosive weight. The distance 73 feet, for instance, was chosen to test a face-to-side orientation for the then-acceptable side-to-side spacing of 1.25 times the cube root of the weight in pounds of the high explosive in storage. The variations in orientations and separation distances of the acceptor igloos would provide maximum data on which to base new separation criteria.

The donor igloo was loaded with 200,000 pounds of high explosive, TNT, contained in 13,696 155-mm projectiles. Pallets filled with the projectiles were stacked inside the donor igloo, in accordance with U.S. Army Ordnance Corps specifications. As the pallets were loaded in the igloo, selected projectiles throughout the stack were primed, and primacord leads were brought forward to extend outside the magazine, where they were bundled. High-explosive charges were also located in each of the acceptor igloos to provide further evidence that DDESB could use in its evaluations. One concrete block building also contained high-explosive acceptor charges; the other contained a Polaris A-3 second-stage rocket motor and a Minuteman third-stage rocket motor.

A B-29 aircraft was placed 1,800 feet from the donor to obtain information on the fragment damage that might be incurred by an aircraft at that distance from a magazine explosion. Fragment search areas were also plotted and cleared in preparation for the test. Some of these areas would be searched on foot after the ESKIMO blast; others would be searched by magnet truck.

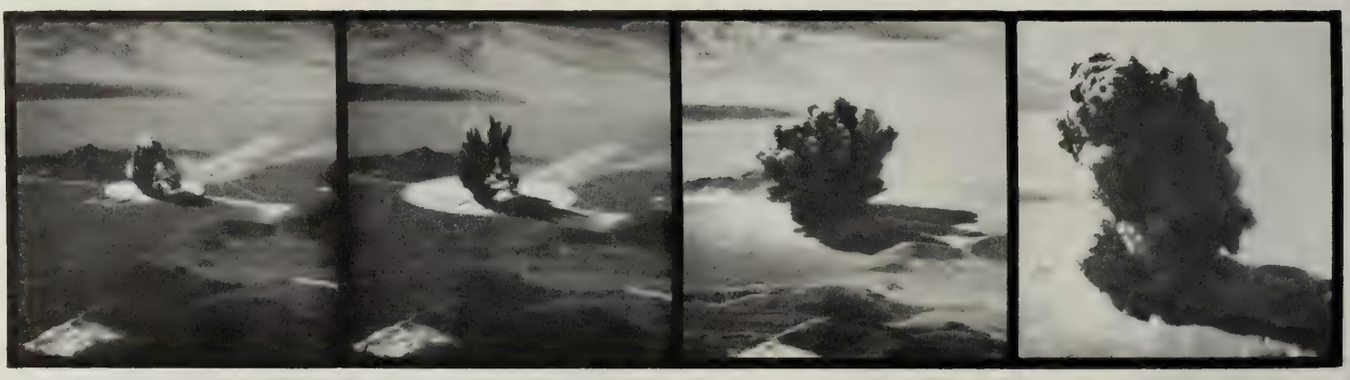


FIG. 2 A B C D

RESULTS OF FIRST BLAST

At noon on 8 December 1971, Col William Cameron III, USAF, then chairman of DDESB, closed a switch setting off the first big ESKIMO blast. As the explosive detonated with an earth-shaking roar, a clearly visible circular area of dust spread with the passage of the shock wave. Metal fragments rained from the sky and raised dust puffs as they hit the desert. These effects are visible in Figure 2.

The explosion caused damage to all test structures, ranging from door damage and minor headwall cracking on the south igloo to complete headwall destruction and acceptor charge detonation at the east igloo. Fragments ranging in size from small gravel to 10-pound chunks pierced the skin of the structurally undamaged aircraft. The concrete block structures were leveled; although the acceptor charges stored in one of these structures did not burn or explode, the two rocket motors ignited and burned. Figure 3, an aerial photograph of the test site, dramatically illustrates the effects of the explosion on the near-field test structures.

FIG. 3



After analyzing the results of the blast, DDESB authorized new separation distances for face-to-rear and face-to-side orientations of earth-covered steel-arch magazines without intervening barricades. Face-to-face orientations both with and without barricades were also adjusted.

PLANS FOR ESKIMO II

Because of the damage sustained by igloo doors and headwalls, DDESB initiated plans for another test, to be held on the same site, to compare door and headwall designs. ESKIMO I results indicated that safety and economy would be increased by closer balance in strength between magazine doors and headwalls. In order to test various door designs, the structures would be sited and the explosive stack designed so that all acceptor igloos would experience the same blast loading, namely one approximating that experienced at the south acceptor igloo in the ESKIMO I test.

In preparations for this new test, two new magazine structures were built, one of which would be a control igloo with doors and headwalls approximately the same as those used in the previous test. The other new igloo was a promising noncircular, corrugated structural steel plate arch, with doors and headwalls adapted from U.S. Army Stradley designs. Three of the basic arch structures remaining from ESKIMO I were to be used in the new test. Figure 4 shows the test layout of these new and pre-existing

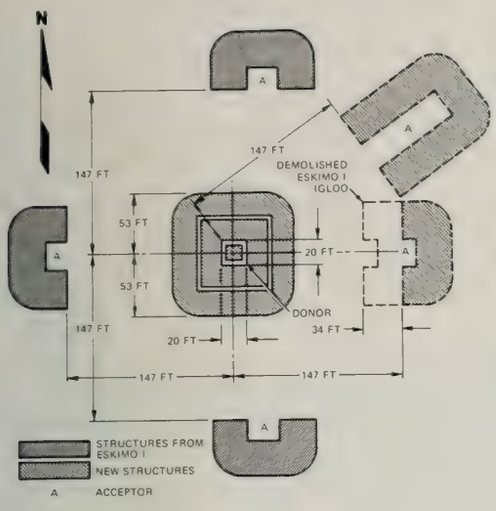


FIG. 4

structures. Headwalls and doors of new, standard, or modified design were added to all acceptor igloos.

For this test, the donor charge was placed within an open-top earth revetment enclosure, surrounded at approximately equal distances by the five acceptor igloos. Two triangular stacks, each consisting of 36 Tritonal-filled M117 bombs, were arranged within the enclosure so that the bombs in one stack were in base-to-base contact with the bombs of the other stack. This donor charge, containing 27,800 pounds of explosives, had an expected TNT equivalent weight of approximately 24,000 pounds. Twelve M15 land mines were used as acceptor charges in each of three acceptor igloos.

In order to make maximum use of the experimental blast, ten wooden test boxes containing window frames and window glass commonly used in institutional or commercial structures were built and placed in the blast field along with motor vehicles. These vehicles and window boxes were located at distances from the blast representing those typical of U.S. and NATO safety practices for locating explosive storage sites relative to highways and inhabited buildings. One vehicle and one window box each contained an anthropomorphic dummy, provided by the Lovelace Foundation for Medical Education and Research, the primary performer of window glass hazard studies and vehicle and traffic route investigations for this blast and for the ESKIMO III test to follow.

Fragmentation data were not sought as extensively in this test as they had been in ESKIMO I; the very nature of the donor, a smaller charge with much smaller metal to explosive ratio, meant that fragment damage to acceptor structures would not be as severe. However, the B-29 aircraft would be studied again for fragment damage, as well as for structural damage. It was patched up and moved to a location 1,210 feet from the explosive site. Fragment search areas were again laid out, and care was exercised to make sure that fragments from the first ESKIMO blast would not be confused with those from ESKIMO II.

ESKIMO II DETONATION AND RESULTS

The morning of 22 May 1973 was beautifully clear. Then a sharp jolt, transmitted through the ground from the explosion, jarred the bunker where the test crew was located. The acceptor magazines experienced more blast than expected—measurements of blast loading made at and near the acceptors during the test show that the actual loadings were significantly higher than the design level, with strong directional effects. The far-field blast was lower than expected. Reasons for these anomalies in strength and directionality are not clearly understood; however, similar effects had been observed in prior tests using donors of similar configurations.

Because the near-field blast loading exceeded that planned, the igloo structures were subjected to a much greater pressure than anticipated, a pressure that caused severe headwall damage, as shown in Figure 5, to some igloos. Despite this overtest, the large single-leaf sliding door on the south igloo withstood the blast loading without severe distortion and none of this igloo's acceptor charges ignited. The



FIG. 5

Stradley-type headwall on the noncircular steel-arch igloo to the northeast, also incurred a clearly acceptable degree of damage. The B-29 aircraft was virtually undamaged.

Serving as a necessary link between the test preceding it and that to follow, ESKIMO II reaffirmed the need for achieving a balance in strength of headwalls and doors. Building on the results of ESKIMO II, the next test would try the very promising non-

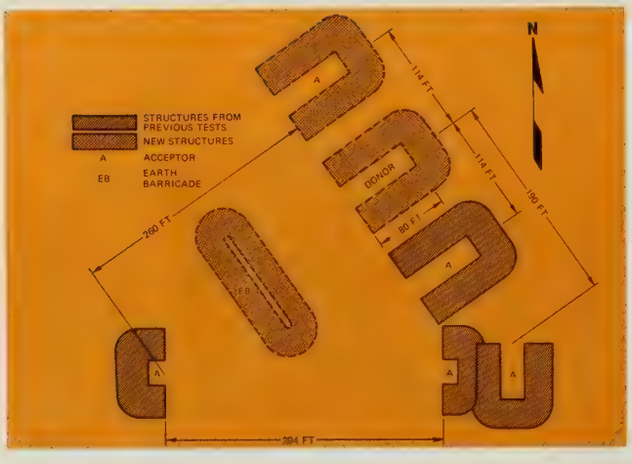
circular arch in combination with a modified Stradley-type headwall and the single-leaf sliding door. Since these igloo components individually withstood the blast well, it was expected that they would form an effective combination for a new standard igloo.

ESKIMO III PREPARATIONS

ESKIMO III would be the biggest blast of the series. It would subject the new earth-covered noncircular, corrugated steel-arch magazine, now with a single-leaf sliding door, to the effects of an explosion in an adjacent magazine at the minimum side-to-side spacing permitted by DDESB standards for previously accepted earth-covered magazines.

To prepare for ESKIMO III, the noncircular steel-arch igloo from ESKIMO II was refurbished, with the addition of a new headwall and sliding door. Two new igloos were built, both constructed according to specifications for standard steel-arch igloos, modified by the use of less expensive light-gauge, deeply corrugated steel in place of the usual heavy structural plate. One of these igloos would serve as the donor. The other would test the theory that earth cover is the most important factor in preventing explosion communication. Three other acceptor structures remaining from previous tests were rebuilt and were fitted with new doors of various designs. The ESKIMO III test layout is shown in Figure 6.

FIG. 6



One of the pre-existing structures, located southwest of the donor, would be tested for face-to-face exposure to an explosion. This orientation had been tested in ESKIMO I at a separation distance that proved too close to the blast. For the ESKIMO III test, the acceptor structure would be located midway between this distance and the untested standard distance. An earth barricade of standard height was built to separate the face-to-face igloo from the donor.

The explosion source, 908 M117 bombs totaling 350,000 pounds of Tritonal, was stacked in the donor igloo, with detonating cord running in equal lengths from several bombs on the periphery of the stack. It was felt that post-test inspection coupled with acceleration and displacement measurements on the arches of the noncircular arch igloo and the light-gauge circular arch igloo would furnish adequate data for an accurate estimate of the risk of explosion communication to the igloo's contents. For this reason, acceptor charges were omitted from the ESKIMO III igloos.

As in ESKIMO II, window test cubes and motor vehicles were arrayed at various appropriate distances from the donor, with anthropomorphic dummies placed in one of the vehicles and one of the window cubes. Post-test blast damage analyses would yield more valuable data on the protection afforded by U.S. and NATO safe distances for inhabited buildings and public traffic routes. The B-29 aircraft was left in its ESKIMO II test location, only 1,080 feet from ESKIMO III's donor.

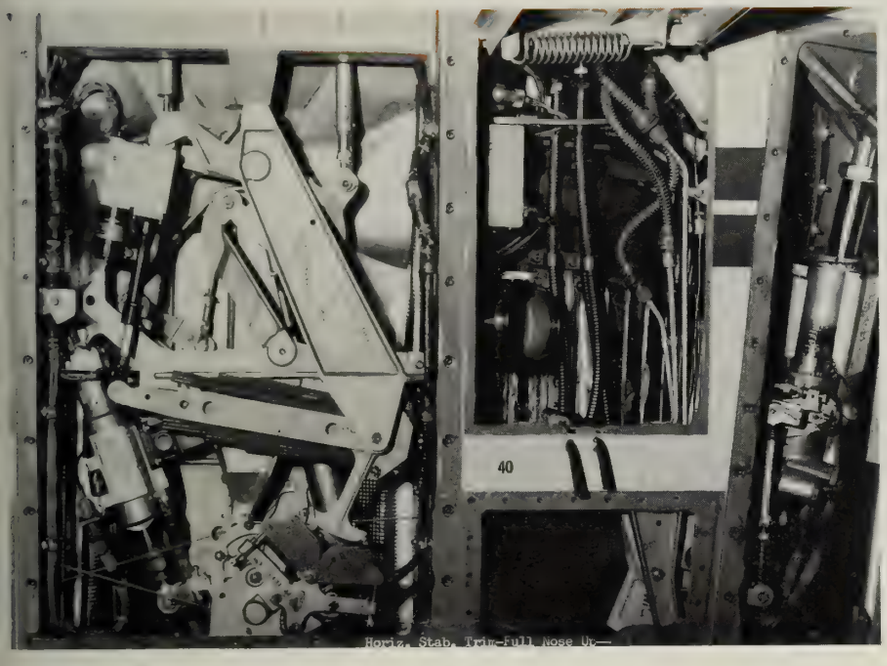
THE BIGGEST BLAST YET

On the morning of 12 June 1974, once it was determined that the area was empty, the switch was closed, and a spectacular fireball rose with a roar over the desert. The earth tremor caused by this ESKIMO blast registered on seismic instruments throughout Southern California.

Test results looked promising. Although the severe headwall and door damage suffered by the face-to-face acceptor igloo indicated that it was still located at an unacceptable separation distance, Board officials were heartened to see the minor structural damage experienced by the noncircular steel-arch igloo. The single-leaf sliding door was removed by the blast from its support rail and was thrown to the ground immediately in front of the door opening; however, any explosive stores within the magazine would have been well protected. The new light-gauge corrugated steel igloo also withstood the blast, but marginally by comparison with other types. Although the aircraft frame was damaged beyond economical repair, the automobiles and window boxes were damaged only moderately. It is expected that, after all the data have been sifted and weighed, DDESB will make new recommendations of great value to explosives safety knowledge. ★

it's all in the rigging

Adapted from Northrop F-5 Service News with the assistance of Mr. B. L. Brigham, Northrop Resident Representative, assigned to the Air Force Inspection and Safety Center.

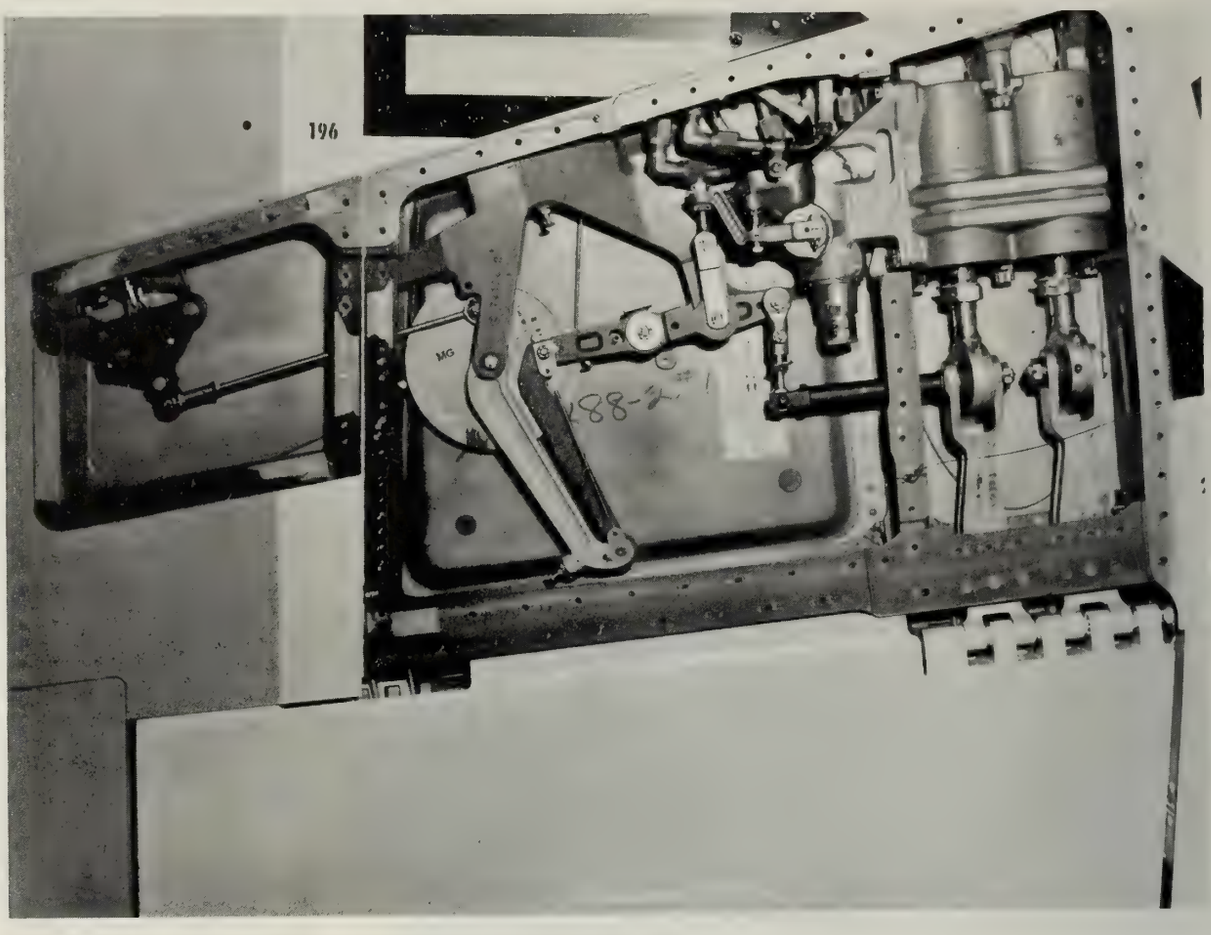


The rigging of aircraft flight controls is a complex and exacting business. The tolerances and proper procedures are clearly stated in tech data. But there is still room for problems, even if the tech data tolerances are met. Historical evidence indicates that those maintenance organizations that try to use optimum settings during routine maintenance consistently obtain better results and get their job done with fewer man-hours per flight hour. On the other hand, those organizations that seem satisfied with any setting, provided it falls anywhere within the allowable range, are the same ones that are constantly burdened with a load of unscheduled maintenance, aborted missions, and other problems.

In discussing the best use of adjustment ranges, it would be a good time to review some of the things involved in establishment of allowables in adjustments, pressures, temperatures, etc. (1) Nothing can be manufactured without some manufacturing tolerances. To minimize costs, manufacturing tolerances are as wide as is practical; precision is expensive. (2) All moving parts wear. This wear can cause a slow change in adjustment. (3) Conditions under which measurements and adjustments are made vary considerably. Temperature, aircraft fuel load, or presence of external stores has an effect. (4) Backlash in linkages prevents use of tight tolerance in some cases. (5) Operating characteristics of some mechanisms change gradually over a period of time.

Now, to get down to the basics of how to adjust within allowable limits. As a general rule, it is best to try for the center of the allowable range. This applies in those cases where a measurement, gauge reading, etc., is specified in a normal way, i.e., 15 ± 5 psi, 14.70 ± 0.50 degrees. Adjusting for the center of the range will generally give the most operating time before any gradually changing conditions result in an out-of-tolerance condition. The center of the range usually results in optimum operation.

rigging cont'd



The next situation is when the range is expressed as a nominal figure with tolerance in only one direction. An example would be the horizontal stabilizer neutral position as listed in TO 1F-5A-2-3, figure 5-2. There, neutral is specified as $17^{\circ} + 1^{\circ}/-0$. With the allowable range stated in this manner, it is generally best to adjust very close to the nominal (17°), but be sure it is slightly in the allowable tolerance direction. In this case, a practical desired setting would be in the 17° to 17.5° range.

A third situation is making adjustments where such things as ailerons or wing flaps are involved and similar adjustments are made on the left and right sides of the aircraft. The two sides should be as close as possible at all checkpoints within the operating range. This synchronization is particularly important for such things as throttle controls where the pilot makes in-flight setting selections, and wing flaps where the pilot has no trim system and the settings affect flight stability.

It is true that it is nearly impossible to adjust to the center of an adjustment range in some cases. This is most likely to happen when there is an interrelationship between two or more adjustments such as up, down, and neutral positions of ailerons. However, it is desirable to balance one adjustment against another as well as possible.

Every month the Air Force spends man-hours and money investigating flight control problems and incidents resulting from out-of-tolerance controls. Not all of these are preventable by accurate rigging adjustments; some are the result of material failures or other circumstances. But, a large portion of flight control rigging problems can be prevented by following a few simple rules. First, look in the tech order. Don't trust your memory, look up the tolerances. Second, check your tools. Worn or makeshift rig pins or other tools do not make for accurate work. Finally, follow the proper procedures in the tech data—don't take shortcuts. By using proper tools, following correct procedures and taking individual pride in doing a little better than just meeting minimum standards or maximum tolerances, you can reduce your workload and improve aircraft operations. ★

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Captain

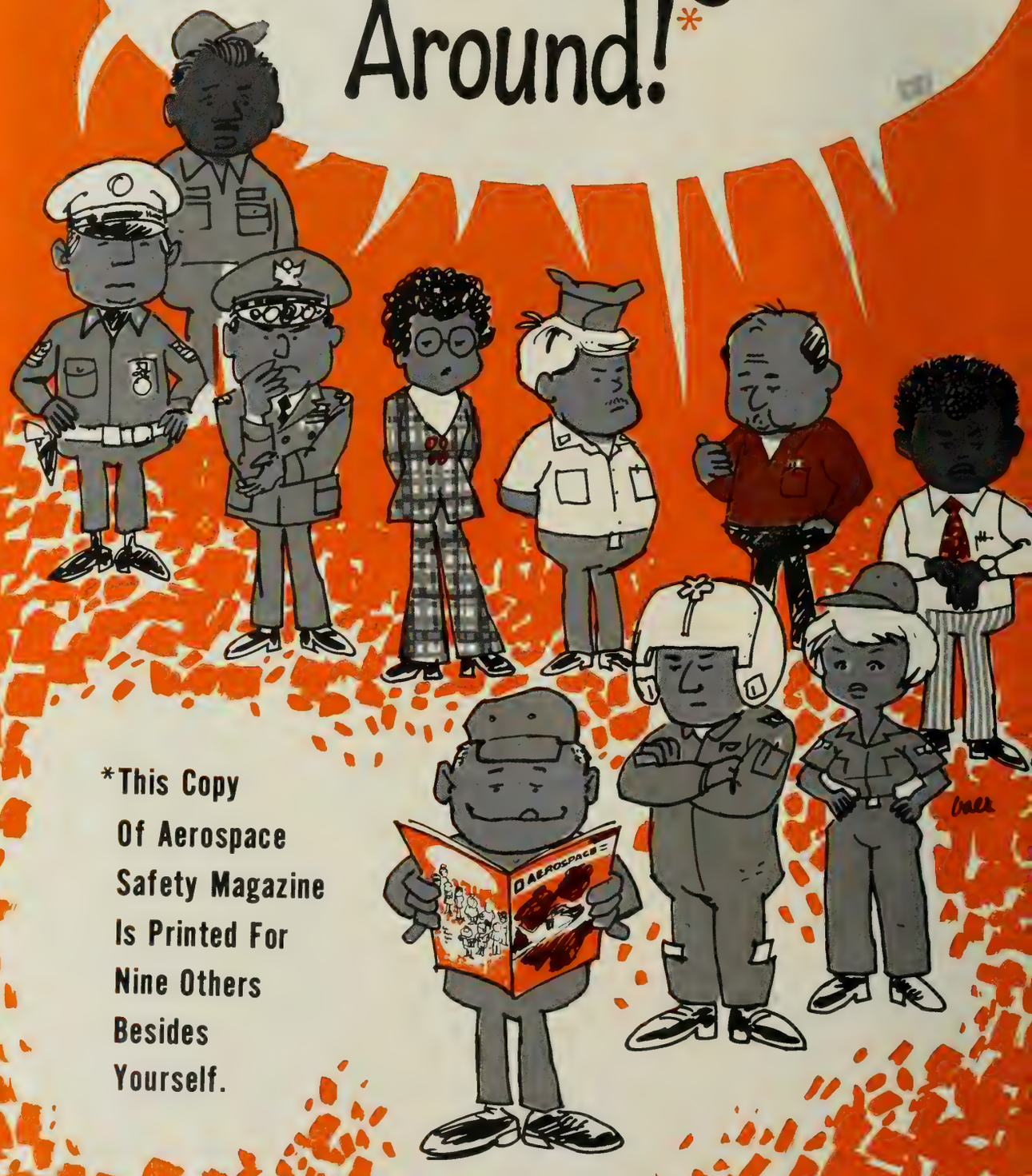
ROBERT A. LAZARO

Det 80, San Francisco University (ROTC)
San Francisco, California

Captain Lazaro was aircraft commander in a T-39 on the evening of 24 April 1974 when the nosewheel axle failed during takeoff. The right wheel separated from the aircraft 300 feet from the beginning of takeoff roll. The left wheel and part of the axle supported the aircraft during the remainder of the takeoff roll, falling off just after liftoff. There was no indication to the pilots of the impending disaster which could materialize during the next landing. An observer on the ground saw the wheels fall off and was able to relay this information to the aircraft. A fly-by of the tower confirmed that both wheels were missing from the nose strut. Captain Lazaro evaluated the situation and requested a 3 foot wide strip of foam be laid on the runway, purposely specifying the narrow width to allow straddling by the aircraft main gear tires after touchdown, insuring controllability during the last phase of the landing. After touchdown, he kept the nose gear strut precisely over the center of the foamed strip and, at a very low airspeed, allowed it to contact the runway. The only damage resulting from the landing was a scraped jackpad on the bottom of the nose gear strut. Captain Lazaro's superior airmanship and accurate solution to his problem possibly saved an aircraft and crew. WELL DONE! ★

Start The New Year Right.....

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*This Copy Of Aerospace Safety Magazine Is Printed For Nine Others Besides Yourself.

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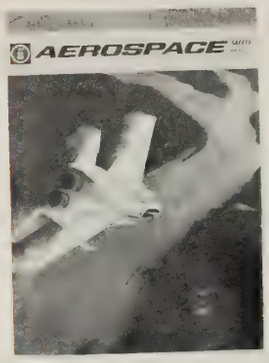
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AT URBANA-CHAMPAIGN

AEROSPACE SAFETY

FEBRUARY 1975



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UNITED STATES AIR FORCE FEBRUARY 1975

AEROSPACE SAFETY

THE MISSION - - - - - - SAFELY!

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FEBRUARY 1975 AFRP 127-2 VOLUME 31 NUMBER 2

A Hot Lucky Day

APTAIN MILTON G. SCHELLHASE
ather AFB CA



t was a sizzling 97 degrees. Out on the ramp it felt more like 147 degrees and everything was distorted by the heat reflecting off the concrete. I was the maintenance officer and as I looked out on the sightline, I saw what looked like water spread under the first four aircraft on the ramp, although it hadn't rained for three months. As the wind shifted I knew what it was . JP-4. I bolted for the hot line in the dock to call Maintenance Control.

Frantically I said, "Have you called wash down trucks and fire trucks."

"The wash down trucks have been called, sir."

"Call for fire trucks," I replied, one spark and the whole ramp will be in flames. And tell them to shut down all vehicles and equipment immediately."

My mind was racing. What next, thought. It looked like a lake out there! I jogged out on the ramp to talk to the line chief who was stopped in the middle of the ramp.

"Where's all the fuel from?" I wanted.

"Left wing of 472," he said, and added, "you won't believe it."

"Probably not," I answered.

Our conversation was cut short by a fleet of fire trucks roaring into place, surrounding the lake. Twelve silver-suited firemen were quickly diluting the awesome hazard that threatened the aircraft.

A quick calculation told me that might owe the government over a million dollars, probably closer to two. At my present salary I would probably be retiring in the year 174.

It took about fifteen minutes but it seemed like hours. The fire fighters were pulling off their silver headgear and walking back to the trucks. The fire chief walked over and said, "Usually you call with a five gallon spill, I've never seen so much fuel. There must be a thousand gallons!"

"Yes," I said, with a nauseous feeling in my stomach.

"What happened?", he asked.

"Don't know, Chief, except that it has something to do with a fuel valve change on 472."

"Call me when you put the pieces together will you, Captain?"

"Sure," I replied, "we'll try not to spill any more gas today."

I'd just come back from lunch to greet this fire drill. It had seemed like a normal day up to that point, two launches, one recovery and three working unscheduled maintenance. I walked over to the senior master sergeant who was my right hand man.

"Let's get the crew chief on 472 and put this one together! I think there will be a few questions about this."

"You said that right!" he replied.

A few minutes later over a cup of coffee, the story unfolded. The plane came in about 0400. The flight crew had written up a fuel transfer problem on number two wing tank. During recovery the ground crew diagnosed the problem as a tank-to-manifold valve failure. So far, so good, one tech sergeant, the crew chief, and two sergeants were working on the recovery. They ordered the valve, and received it before shift change.

Shift change—the beginning of the sticky-wicket. So the ground crew turned it over to Staff Sergeant Johnson and Airman First Class Schwartz. They told Sergeant Johnson that the valve change was ready to go and the new valve was on the navigator's table.

Since most of the rest of the work was done, Sergeant Johnson told Airman Schwartz to pull the old valve and he'd help him put the new one in when he returned from lunch.

"Oh," I said, "Airman Schwartz wasn't using tech data."

"Not quite," he replied, "the valve leads right into the wing tank and the first step in the technical order is to drain the tank. But he had been told that it was ready to go. So he didn't pull the cap or check the gauges in the cockpit. He just started with step two, pulled the valve and—zap—a two-inch stream of fuel onto the ramp."

"Where's Schwartz?" I asked.

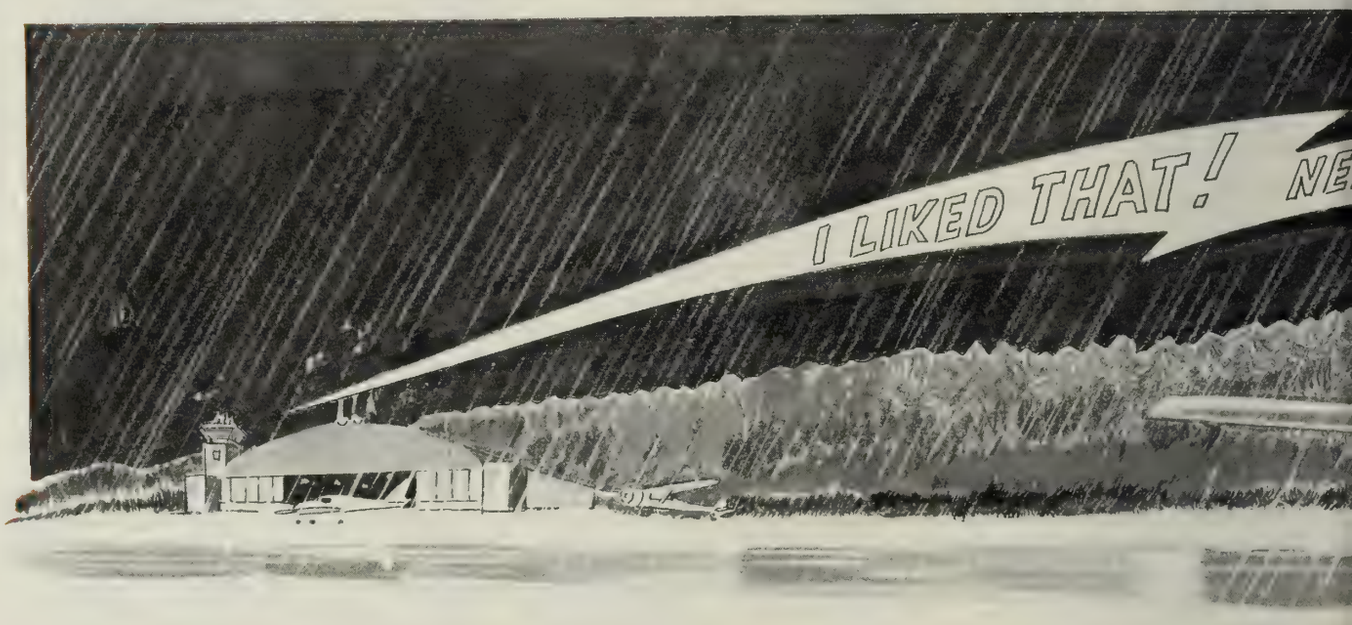
"He got soaked. We hosed him off and sent him home to change."

So that was it. I felt more nauseous than before. I could almost write an accident report. I'd read so many. "Cause: Failure to comply with tech data resulted in the loss . . . Cause: Inadequate supervision led to . . ."

There was no use blowing my stack. I was reflecting on how to tighten up supervision to improve turnovers and, oh yes, use tech data . . . all of it. Usually the worst thing that happens on turnover is lost parts. This time we almost lost four aircraft. But now it was time to call the fire chief and tell a story that would probably be repeated a few more times during the day. I guess I should have been thankful, it was my lucky day. Mostly I just felt ill.

"Hello, Chief, you aren't gonna believe the story about the fuel spill" ★

KNOW YOUR



My first day under the hood of a T-6 wasn't particularly satisfying. I remember very little about the experience except that afterwards I felt very inadequate. During the debriefing, however, my instructor told me something I will never forget. "Instrument flying is a lot like getting along in the Air Force and life. Attitude and position are everything. Your attitude must be positive and under control and you must be absolutely certain of your position before moving ahead to another."

Aircraft instrument developments over the past 20 years have made attitude control accidents very rare. Gyros don't tumble now, stand-by gauges are installed, electrical systems have become redundant, failure warning systems have been added, and so on, and so on. Position accidents, on the other hand, continue to occur with agonizing regularity. Aircraft position can be thought of in four simultaneous relationships to a point over the ground: Longitudinal, lateral, vertical and time. The use of all available navigation aids to accurately determine the aircraft's position is essential to long life and a successful career.

The most humble person I ever heard of was the airline pilot who mistakenly landed his 707 on a 3500 foot private strip near Columbus, Ohio. After the passengers had been transported to their destination by bus, he personally apologized to each for the inconvenience he had caused them. Humble but courageous.

I was talking to the fire chief at Chu Lai shortly after a contract carrier captain landed his DC-8 on the 3000 foot strip at Marble Mountain instead of the 10,000 foot runway at Da Nang. The chief said: "That man was a pretty poor navigator, but one hell of a pilot." Both of these pilots were lucky to be alive, but, being "a hell of a pilot" is little consolation if you can't position the aircraft at the right runway.

There are two C-141 crews who are lucky to be alive, because they knew their position relative to an airport and were able to position their disabled aircraft over the runway before it touched down. The first was on a formation training mission when the thrust reversers deployed on three engines. All efforts to close them were futile. With one engine shut down, two in reverse idle, and one at TRT plus, the pilot was able to maintain just better than stall speed with a 6000 foot per minute rate of descent. As the aircraft came out of the 10,000 foot overcast, the pilot put the gear down and flaps at APPROACH. A minute and one-half later, with a tremendous flare, the aircraft was safely on the ground at Baker, Oregon, Municipal Airport.

In the other case, the aircraft was on downwind for a VFR approach to Addis Ababa IAP when a hard over aileron condition materialized. The pilots fought the roll with aileron and rudder. The airplane completed 180 degrees of turn and was sliding out of the sky with nearly 90 degrees of bank. As a last resort the pilot firewalled the low engines and idled the high engines. The airplane grudgingly responded and as it came to a wings level position, touched down 3000 feet down the runway. The pilot deployed the spoilers and jumped on the

POSITION

MAJOR CHARLES L. POCOCK, JR.
Directorate of Aerospace Safety



brakes, completing the landing without even catching a wing tip. This was a fortuitous coincidence of aircraft and runway positioning that would befuddle the odds makers.

A bet no odds maker would touch is one on the pilot who doesn't respect MEA's, MOCA's, minimum sector altitudes. There are several grey areas that are not addressed in AFM 51-37, but keep in mind that in a non-radar environment the pilot is solely responsible for terrain avoidance. Many of us have flown and trained in a radar environment so long that we mistakenly use the same procedures when suddenly presented with a non-radar situation. In a non-radar environment there are only three times a pilot may descend below published MEA, MOCA, or minimum sector altitudes, regardless of the clearance received: (1) When you are VMC and can remain VMC until landing, (2) after station passage and established on the published outbound course, (3) when established in a published holding pattern. Pilots who didn't follow these three rules have scattered airplanes over the landscape of the entire world.

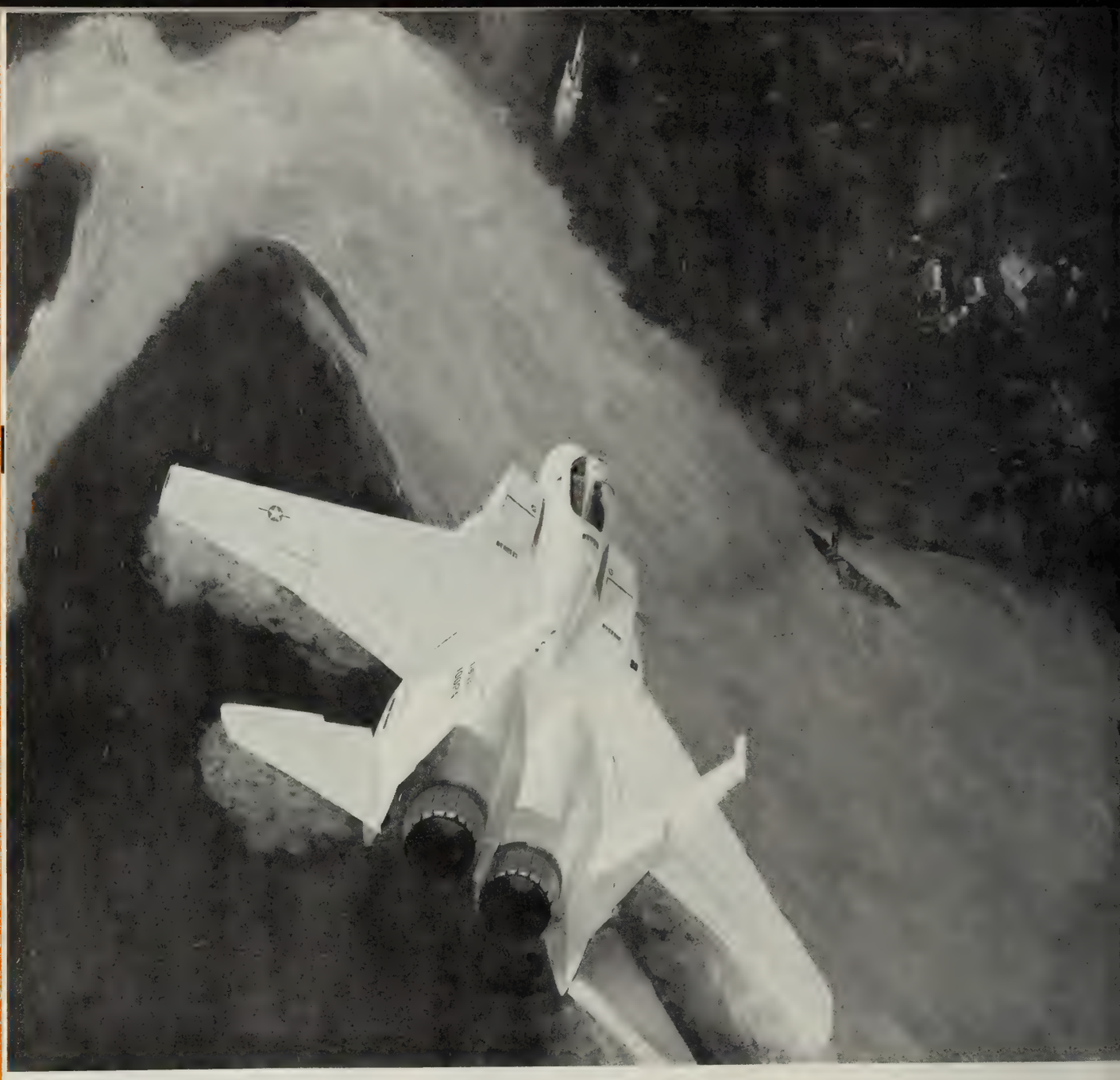
A DC-8 pilot received a clearance, "cleared for an approach," and started descending to the initial approach altitude. The IAFA was several thousand feet below the MEA and the minimum sector altitude, and the aircraft was several miles out. The last item on the cockpit voice recorder was the copilot stating, "according to the radar altimeter we're 400 feet above something."

A heavy jet transport was descending for approach. At 24,000 feet and about 4½ minutes out he received a clearance to descend to 18,000 feet, which was the initial approach fix altitude. Two and a half minutes later the aircraft crashed into a 20,000 foot mountain at the 18,600 foot level. The minimum sector altitude was 24,100 feet and the MOCA was 24,000 feet. Unless you are on radar vectors. a clearance to descend does not mean you will be clear of terrain.

"Checkee you watch or make seven-hundred-twenty degree turn to right" was my clearance when I incorrectly reported my position and time at MIHO radio. I had glanced at the clock and the minute hand was clearly pointing at four, but I had a mental short circuit and erroneously reported MIHO at "Two Five." The alert FSS operator immediately challenged the 5 minute error to maintain airway separation. Now, I try to "Checkee my watch" closer.

The crew of a C-124 obviously didn't "Checkee their watch" when they impacted the jungle, wings level, 22 miles and more than 5 minutes past the missed approach point. They were apparently concentrating so hard on tracking outbound from the NDB and looking outside for the runway in the night fog that they lost track of the missed approach point.

ADIZ and ATC violations for being off track are unpleasant enough; but a track violation by mother earth can ruin your whole life. From the Spad to the F-111, pilots have tried to argue with mountains. None have won and few have survived to claim second best. Position may not be everything but it sure beats being out of position. ★



PRIDE

MAJOR JAMES I. MIHOLICK
Directorate of Aerospace Safety

. . . can do strange things. It's probably more often blamed than credited for having caused various phenomena, including wars. It's known to "goeth before a fall," it's painted in giant letters on many SAC hangars, and, among other things, generally thought of as something that Marines and fighter pilots have a lot of. It is a lot like many things that come to mind, i.e., a certain amount of it is necessary; too little or too much is considered bad.

Pride is a very fragile thing, easily damaged, carefully guarded,

demanding of constant attention. If ignored, it consumes great quantities of judgment, awareness, and curiosity; simultaneously generating large amounts of complacency, conceit, and over-confidence. If respected, it motivates self-improvement efforts, increases the desire to excel, and allows for a realistic assessment of one's actual, rather than imagined, capabilities.

A "can do" attitude is too often embraced without reason or limitation. We consider the individual who died trying far superior to the individual who wouldn't even try, without realizing they both represent an extreme. We don't consider before-hand that he who dies trying totally eliminates the possibility of success, and becomes the equal of he who didn't try. For some reason we don't equate the daredevil who dies trying to ride a motorcycle through fire to the pilot who dies trying to attack a target he can't see from a normal base leg altitude. Both of them have much in common: they both thought they could, they both couldn't, they both failed. For whatever the reasons, improper equipment, improper training, improper odds or improper "pride" level, neither accomplished his mission. Was either more successful than he who didn't even try? At this point, he who didn't try has infinitely greater odds of success, if only by default. He at least still has the option of trying.

Obviously, neither extreme will accomplish the mission. Success depends on tempering pride with judgment, even patience. We have to occasionally add to the "I can do it" attitude thoughts like "on the next pass," "when the weather's better," "if I had a different kind of airplane," or, "as soon as I get some more practice." We must weigh the criticality of the task against the odds of success. Tunnel-vision on the objective is considered heroic in combat, but not on a peacetime local training mission.

Perhaps our "war games" are too realistic to those who haven't been there: maybe we aren't convincing Blue 4 that hundreds of lives *don't* depend on the success of his dry pass on that jeep hidden next to the road on the tac range.

Close air support training missions are fun, but they must also be educational. They must be used to develop the skill required to be successful in real combat, and part of that skill is the ability to assess the situation and apply the tactics that will maximize the odds of success. We have to remind ourselves that the objective of a simulated close air support mission is *not* to destroy targets. It is simply to practice the tactics and develop the skills that would give us the best chance of destroying a target *if we wanted to!* The loss of an airplane and pilot in combat is not normally considered totally useless. There is no other way to describe that loss on a tac range during peacetime.

The situation within the tactical fighter community right now is probably more hazardous than it has been for many years. We've been at "war" for nine years, and the great majority of fighter pilots have combat experience. It's easy to become a little too relaxed in the relatively safe training environment, for, in fact, the odds of disaster are much less than we so vividly remember. Combine this with the fact that our proficiency is lower than it was in combat; we simply don't fly as much. It's far too easy to project back to combat flying. How many of us feel that we've "done it all" under the most hazardous conditions in the history or aerial warfare? Is this false pride? Probably not, for it *was* tough, and we *were* good.

How many of us feel that, since we proved we could do it then, we can still do it now (with only 10 or fewer sorties a month instead of the 20 or more we were getting then)? False pride? Consider that we project this, "I can do anything" attitude to the new guys; that we tell them, *"if you don't know who the world's greatest fighter pilot is, you aren't one."* On the other hand, how often do we remind Blue 4 that to become the world's greatest fighter pilot, he must know his limitations and work to improve them. We have to emphasize that the world's greatest fighter pilot isn't stupid, that he doesn't kill himself trying to strafe a ten-dollar enemy bicycle under a 500 foot overcast, that he doesn't spin in trying to turn with a MIG. He knows what he and his airplane can and cannot do! He does not say, "I can do anything." He does say, "I can do anything within my and my airplane's limitations (and those things I can't do, I'll work my tail off practicing until I learn how)." In short, he is proud, but he is smart enough to know that pride can kill him if he doesn't respect and control it.

Hopefully, the right hand will continue to enjoy a 50:1 kill ratio over the left hand in the bar hassles. Fighter pilots will continue to do it better, best, or on the first pass. It's fun being good, but let us not be so good it kills us. As poorly as it tastes, some pride occasionally must be swallowed for survival's sake. And survival is what it's all about; at least in terms of self-generated losses. A prerequisite to being the very best is, obviously, "being." We must keep sight of the very reason for our existence, for our ability to do our job depends not only on our skill, but our numbers. There is one thing better than having the best fighter pilots in the world, and that's having a lot of them! ★

POWs & LSE*

*Life Support Equipment

PART II

ROBERT H. SHANNON
Directorate of Aerospace Safety Ret

This paper, the second of two, will address the phase between shootdown and parachute landing of the 207 ejections/extractions/bailouts experienced by our Vietnam POW returnees. The specific method of shootdown will not be discussed, as it is not considered pertinent to this paper. What is important is that the emergency was usually catastrophic in nature, which necessitated immediate action and sometimes extraordinary efforts to abandon the aircraft.



The conditions of ejection were different from those observed in noncombat operations. As with previous analyses of combat escape experience, delaying the decision to eject is not a factor to be reckoned with. Almost one-half of the returnees stated they were out of the aircraft in less than 30 seconds. Obviously, there was precious little time to assess the situation or try and reach a more desirable bailout area. Delaying the decision to eject has been and continues to be a most critical factor in the outcome of ejection in the noncombat environment.

There were 13 different aircraft types involved in in-flight egress by the 207 crewmen, with two aircraft types accounting for 75 percent of the total. The personnel involved included 77 with major injuries, 85 with minor injuries, and 42 who were uninjured. In two cases the degree of injury, if any, was not reported. It should be noted that these are injuries incurred during the escape and evasion phases and do not include those received during or subsequent to capture. The 37 percent major injury rate is significantly higher than in noncombat ejections which averages between 15 and 25 percent. When the conditions of the combat in-flight escapes are considered, it is quite remarkable that the major injury rate was not much higher. The major injury rate among Navy POW returnees was reported to have been 52 percent.

In our examination of flight conditions at time of egress, the first consideration was the attitude of the aircraft. Less than 20 percent of the returnees reported the aircraft to be in a favorable attitude for egress; that is, straight and level or slightly nose-up. More than half were encountering such extreme conditions as rolling, tumbling, spinning, and oscillating. In almost 10 percent of the cases the aircraft was actually in the process of disintegration when the escape sequence was initiated.

Altitude of egress showed some rather interesting findings. Fourteen percent of the returnees reported that escape was initiated at altitudes above 20,000 feet. This is comparable to what has been observed in noncombat experience, but significantly higher than the 3 percent reported by the combat ejectees who were subsequently recovered. This increased proportion of high altitude escapes by the returnees is no doubt due to the introduction of the B-52 late in the conflict. Actually, the proportion of escapes at various increments of altitude by the returnees closely approximated that of noncombat escapes. For example, 8 percent of the returnees initiated escape below 500 feet as compared to 13 percent among the noncombat escapees. Total escapes below 10,000 feet were 66 percent and 60 percent respectively, and between 10,000 feet and 20,000 feet the proportions were 20 percent and 23 percent respectively. Only 4 percent of the recovered survivors of combat mishaps initiated escape below 500 feet; 79 percent were below 10,000 feet, and 18 percent between 10,000 and 20,000 feet.

The relatively small number of escapes at low altitude by both the returnees and recovered survivors is indicative of the absence of delayed ejections in the combat environment.

The most startling finding is the number of extremely high speed ejections. Of those cases in which speed at time of ejection was known or reported, almost one-half occurred at speeds above 450 knots indicated. There were 18 between 450-499 knots indicated airspeed (kias) with four major injuries, one of which was attributed to windblast/flailing, 44 were initiated at between 500 and 599 kias. There were 20 major injuries in this group, with seven being related to windblast/flailing; finally, there were nine ejections in excess of 600 kias. Four of six major injuries in these cases were due to the effects of windblast. Thus, of 71 total ejections at speeds above 450 knots indicated, 30 crewmen received major injuries, and only 12 were directly attributable to high Q-forces. Noncombat experience has consistently shown a very limited exposure in the higher speed ranges. For example, in a recent 3-year study of 325 noncombat ejections, only seven were initiated at speeds of 450 knots indicated, with one related injury. The combat experience quite dramatically illustrates the effectiveness of open ejection seats at high speed.

Most of the high-speed ejections involved ejection seats with lower extremity restraints. System initiation was by either sidearm controls or the seat-mounted D-ring. The fact that the seat-mounted D-ring was adopted by the USAF as the primary method of ejection in the F-4 may have had a bearing on the low incidence of upper extremity flail injuries.

This experience resulted in several valuable findings concerning extremity restraints. Unstable low density seats must provide some means of restraining the lower extremities in case of high speed ejection. Lower extremity restraints were

removed from one ejection seat because operational experience showed that they were not necessary and the crew members were not using them. Shortly after the aircraft entered combat there was a high incidence of serious lower limb injuries among the ejectees. The restraint system was subsequently reinstalled. In another aircraft the lower extremity restraints, which were already an integral part of the ejection seat, had to be modified to provide better protection against the effects of ejection at extreme speeds.

The problems reported by the returnees during and immediately after egressing the aircraft provide a real insight into the conditions of escape.

It was not unusual for one individual to encounter multiple egress problems. In all, 448 egress problems were reported by the 207 escapees. The vast majority occurred immediately prior to and during the egress episode. The magnitude of egress problems in combat becomes quite evident when compared to a recent study of 325 noncombat ejections in which difficulties were encountered in 75 instances. The major combat ejection problems involved the effects of G-forces, windblast, and buffeting. These categories accounted for 66, 68, and 44 cases respectively, or 40 percent of the total. The frequency of these factors is indicative of the conditions of ejection precipitated by combat mishaps. G-forces, windblast, and buffeting cause delays in locating and actuating ejection controls and assuming a proper ejection posture; also frequently serious injuries from flailing of extremities.

The next most serious problem reported was that of fire and smoke in the cockpit or crew compartment area, which was reported in 46 instances. It is understandable why this is a frequently reported problem with combat-damaged aircraft, while it is almost nonexistent in noncombat operations. The confusion and delays in escape due to fire and smoke are obvious. The age-old problem of difficulty in locating and actuating ejection controls was reported by 41 of the USAF returnees. This is also a frequently reported problem in noncombat. No doubt some are the result of other factors, such as confusion, fire/smoke, etc., but others are directly related to the lack of standardization of ejection controls.

Flailing of extremities occurred in 38 cases. In view of the numbers of ejections reported at very high speeds, it is quite remarkable that this was not much higher. It is even more remarkable that only 12 serious injuries were due to this cause.

In 32 cases, confusion/disorientation/panic/darkness occasioned by the severity of the emergency were reported as detriments to escape. In 22 cases, injuries incurred hampered the escape effort; 21 crewmen were hampered or struck by equipment; 15 struck cockpit structures, seven reported seat/man/parachute involvement; and five experienced seat separation problems.

There were 43 additional egress problems categorized as "other," which were distributed among 13 different causes. These included such things as spinning and tumbling prior to and subsequent to seat separation, anthropometric problems, striking external aircraft structures, survival kit deployment problems. One crewman had failed to remove the ejection seat ground safety pins, and there were 11 system component failures. The latter included the seat-man separator—1 case; canopy/hatch failure—4 cases; seat sequencer for fore and aft seats—1 case; and one crew member's seat failed to fire. He was subsequently able to manually bailout.

Following parachute descent, which was not always uneventful, as it was not unusual to take a few rounds from enemy forces in the area, landing was made in varied environs. As would be expected for this area, the largest proportion of parachute landings was in wooded areas, which accounted for over 30 percent of the total. The remainder were distributed among nine additional categories.

In summary, the information provided by the returned POWs has filled a vital life support information gap. The USAF now has a complete data bank concerning the use of life support equipment/systems in the combat environment. The experiences of the returnees have shown that existing Air Force aircraft escape systems have performed exceptionally well under the most adverse conditions. They have also provided the all-important data base that will ultimately enable us to provide the Air Force crew member with the best possible life support equipment systems to sustain him in any environment. ★

THE IFC APPROACH

By the USAF Instrument Flight Center, Randolph AFB, Texas 78148

ALTITUDE REPORTING

Q: I am flying at an assigned altitude in an air traffic control area that has the ability to display aircraft altitude readouts on its radar scopes. If I deviate from my assigned altitude, will the controller query me?

A: If the controller is using your altitude readout for traffic separation, he should request that you verify your altitude if his readout differs by 300 feet or more from the altitude you have been assigned. If he is *not* using your altitude readout for traffic separation, the controller has no requirement to query you; however, he may if he sees you off your altitude. You, the pilot, have no way of knowing which case applies to you at any given time, but it is important to remember that, in either situation, the controller may be working a large number of aircraft and therefore might not notice your altitude change for some time. The point is this—though the controller's request for altitude verification *may* be a good backup for pilots who become distracted and stray from their assigned altitude, don't become complacent and rely upon the controller to keep you on your altitude. As with most things, it is ultimately the responsibility of the pilot.

Q: What if the controller asks me to verify my altitude and finds that his readout and my readout are different?

A: If you are using the proper altimeter setting, your readouts should be the same. If your readout and the controller's differ by 300 feet or more, he should instruct you to turn off the altitude reporting portion of your transponder and tell you that it is evidently malfunctioning. You can then write it up so maintenance can check it out.

CIRCLING INSTRUCTIONS

Q: I am flying a published approach to Runway 36 intending to circle to land on Runway 18. The controller issues me the following instructions, "Circle to Runway 18, circle right." Does that mean turn right initially to end up on a left base to final, or turn left initially to end up on a right base to final?

A: If a controller uses that particular terminology, there is no way to tell exactly what he means without further clarification. It would have been more understandable had he said, "Circle to Runway 18, circle for a left base."

Q: Isn't there standard terminology for giving circling instructions?

A: Yes, but currently it is only as follows: "Circle to runway 18." Further instructions are not presently standardized—but help is on the way! Starting 1 April 1975, if the controller has a requirement to specify the direction of the circling maneuver in relation to the airport/runway, he will issue instructions in the following format: "Circle (direction given as one of eight cardinal compass points) of the airport/runway for a right/left base/downwind to runway (number)." For example: If the controller wanted you to maneuver your aircraft as shown in Figure 1, his instructions would be, "Circle west of the airport for a right base to Runway 18." Until these new instructions are being used by controllers, or any time you have a doubt about what your actions should be, ASK!

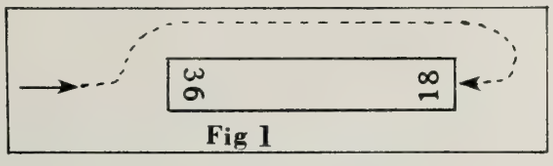


Fig 1

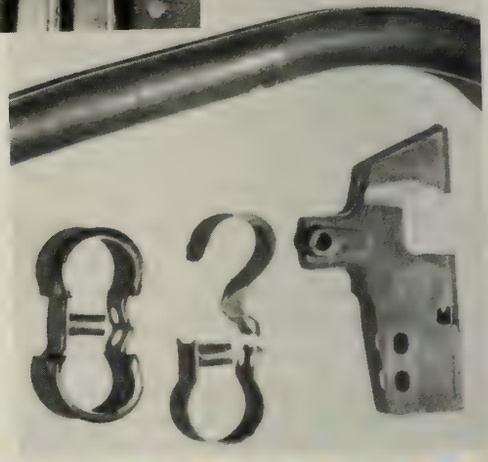
CIRCLING MDA

Q: When can a pilot descend below the circling MDA during a circling aproach?

A: Remember the MDA is a minimum altitude. If weather permits, we recommend a circling approach be flown at the normal VFR traffic pattern altitude. This would allow the maneuver to be flown with the perspective and visual cues normally available during landing. If weather does not permit circling above the MDA, the MDA should be maintained until the aircraft is in a position to execute a normal landing. Then descend from the MDA as necessary to place the aircraft on a normal glide path to the landing runway. Be aware of the common tendency to overshoot final from a lower than normal traffic pattern. ★







CAPTAIN
JON R. NEW
Directorate of
Aerospace
Safety

Clippity Clampity...Splat?

Chafing clamps are an old problem which we haven't solved. It's easy to identify the results of chafing that has caused a line to fail. When there is a materiel failure that results in an incident or an accident, the materiel deficiency system must be used and QC, MAJCOM, AFLC, and HQ USAF personnel become **very** interested in the problem.

The need for all maintenance personnel to be acutely aware of potential clamp failure and to frequently inspect these areas is readily apparent when one reviews recent EUMRs, incidents, and accidents. For example:

B-52, SAC, Oct 74—Improper torquing allowed clamp to vibrate loose.

T-37, ATC, Oct 74—Tail pipe clamp broken.

KC-135, SAC, Oct 74—Line was improperly clamped and positioned allowing this line to chafe . . . until the line wall wore through and began leaking.

A-7B, Navy, Nov 74—Parachute ripcord housing cracked due to inadequate support in area of release clamp.

F-111F, TAC, Nov 74—Air ejector tube crushed by clamp.

F-4J, Navy, Oct 74—Throttle stuck at 98 percent. Loop clamp positioned too far forward on fuel line and prevented normal retardation of throttle when it caught on the throttle control box torque shaft bolt.

Just a sample of one day's messages.

Although the problem isn't readily resolved, there are some things that can be done to reduce improper clamping. Yes, those little mechanical devices that are designed to help prevent chafing can actually cause the failure that the clamp is designed to prevent! In this article, we want to review "clamps" and determine what can be done to reduce the problems associated with the little buggers.

The best source of general information to turn to first is TO 42E1-1-1. Para 3-8, "When hose is installed through holes in brackets, or when supporting

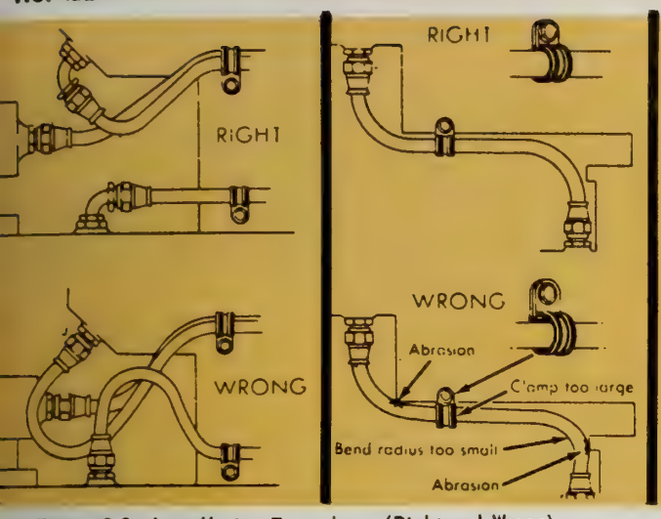


Figure 3-2. Installation Procedures (Right and Wrong).

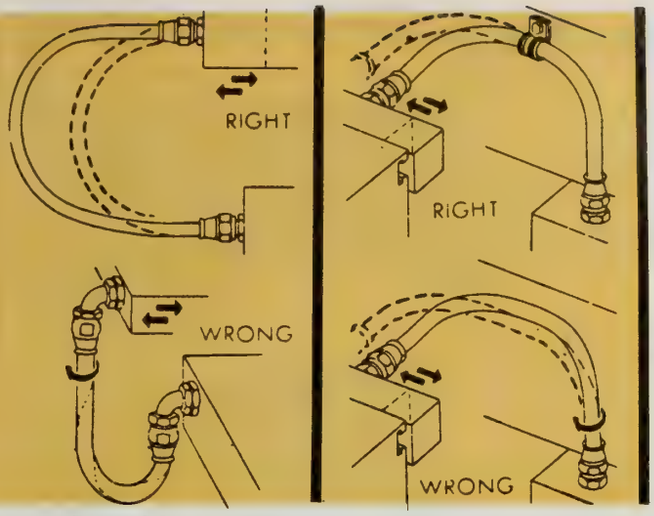
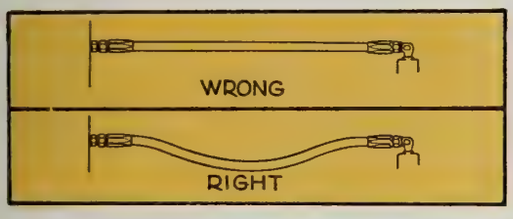
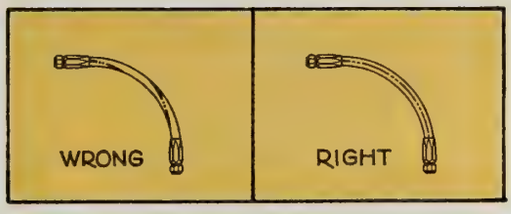


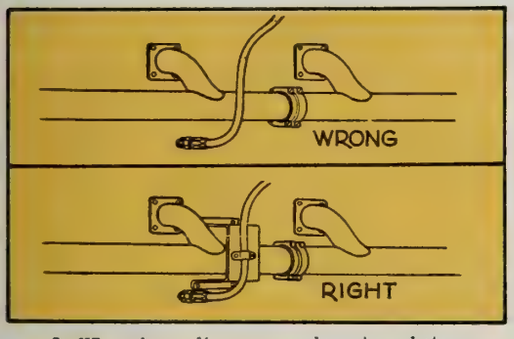
Figure 3-3. Installation Procedures (Right and Wrong)



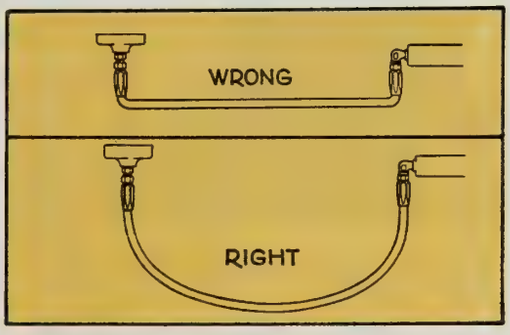
1. Remember that the hose will change in length from + 2% to – 4% when pressurized. Provide slack or bend in the hose to compensate for any changes in length which might occur.



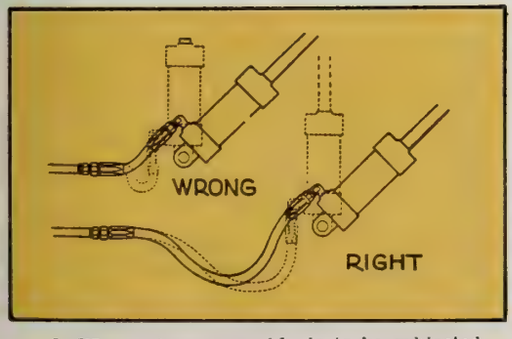
4. If high operating pressures are applied to a twisted hose, the hose may fail or the attaching nut become loose.



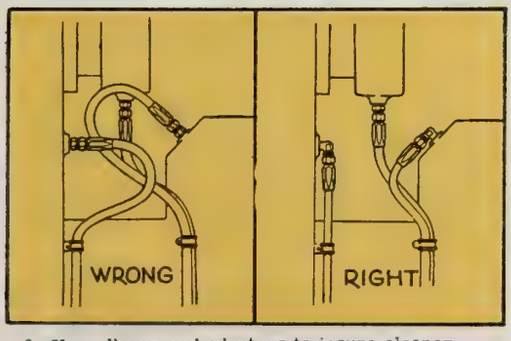
2. When hose lines pass close to a hot exhaust manifold, protect the hose with fire proof boot or metal baffle.



5. Keep the Bend Radii of the hose as large as necessary to avoid kinking of line and restriction of flow.

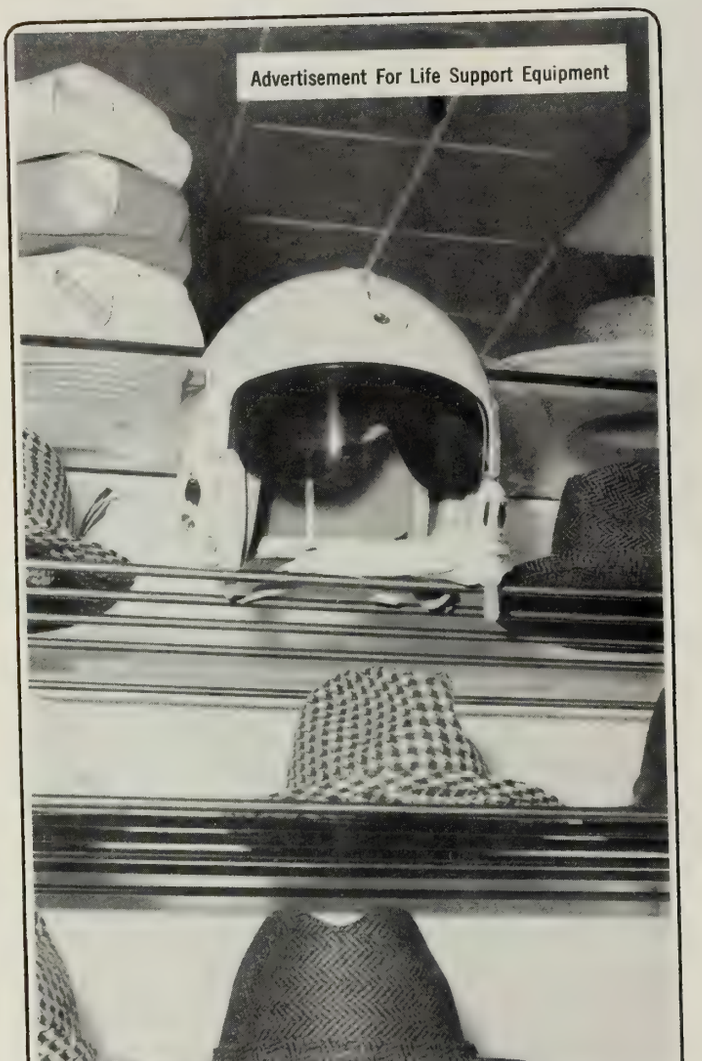


3. When a hose assembly is to be subjected to considerable flexing or vibration, remember that the metal hose fittings are not part of the flexible portion.



6. Use elbows and adapters to insure cleaner installations for easy inspection and maintenance.

Figure 3-4. Hose Line Installation Aids for All Types of Hose.



Which Hat Belongs To The Guy Who Runs A Five Million Dollar Business?

The HGU-2A/P aircrew protective helmet provides superior head protection and can be custom fitted to individual head peculiarities. Outside noise interference is virtually eliminated.

The helmet modification outlined in TO 14P3-1-121 involves replacement of the standard liner with a custom molded polyurethane foam liner which is poured locally. This modification provides better comfort, noise attenuation, stability during high G loads and aids in helmet retention in case of bird strike, canopy loss or ejection.

THIS PRODUCT BEARS THE LIFE SCIENCES SEAL OF APPROVAL

USAF LIFE SCIENCES AUTHORIZED EQUIPMENT

Another Fine Product Of Your USAF Procurement System

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clips are used, there must be no reduction in the diameter of the hose. If this condition is present, the flow will be reduced and damage to the hose may occur." The damage to the line is caused by the surging of the fluid through the line. The pressurization and depressurization of the line causes wear at the point of restriction. Over a number of system operations, this effect can cause the line to wear (chafe) from the inside as well as the outside at the point of restriction.

Para 3-9, "Support clamps at least every 24 inches. Closer supports are preferred . . ." This requirement makes sound knowledge and frequent inspection a must. It also rules out the solution often presented without indepth thought, namely, "If the clamps are causing chafing, just take 'em off." They are needed to prevent other serious problems.

Para 3-10, "Select proper size support clamps." Easier said than done? Not really! Tables 3-III, 3-IV, and 3-VI provide the proper size of support clamps and teflon chafe guards for each hose size for different Mil Spec hose sizes.

Paragraph 3-IIb provides the general precautions, "Hose flexing in two directions shall be clamped at the point where hose changes planes. This has the effect of dividing the hose into sections, each in one plane." The figures (Figs 3-2 and 3-3) provide an easy understanding of this requirement.

Para 3-15, "Whenever a length of hose is connected to the engines with a hose clamp, firmly support the hose in a manner that will prevent vibrational and tensional strain on the hose connection. Whenever possible, place the support approximately three inches from the engine connection." This aspect of clamping requirements is critical. The lines in the engine bay area are crucial due to the high vibrational stresses and strains in the area. Most clamp failures occur in the engine bay.

These are some very general guidelines to solving the clamping problem; but you should review TO 42E1-1-1. It contains other information on lines and hoses, but it is beyond the scope of our present review. Your specific aircraft TOs contain the specific inspection and replacement criteria for your airplane.

In summary, clamps serve a purpose in securing lines and preventing chafing due to vibration. Lines which are properly secured, clamped, or braced, in accordance with the appropriate technical order, will reduce your maintenance problems. Only a thorough knowledge of your aircraft technical orders specifically, and TO 42E1-1-1 in general, will enable you to determine that the lines are properly secured. Don't let the clamps ground you! ★

MISSILE TOPICS

ALL STORIES SHOULD HAVE A HAPPY ENDING

Four Minuteman maintenance technicians were recently exposed to sodium chromate vapors at a launch facility. How can you have vapors from sodium chromate in a launch facility? In this case it appears that sodium chromate was leaking past a failed pump packing with the fluid possibly coming in contact with the rotating shaft of the motor generator.

More recently another sodium chromate exposure was experienced by a maintenance technician working on the liquid guidance cooler in another launch facility. While attempting to remove the filter element housing, he was struck on the top of his head by a spray of sodium chromate solution from an improperly seated poppet valve. The solution ran down behind his face shield into his eyes.

Some ill effects were experienced by the men but all recovered quickly without injury. A happy ending? You bet, but it was no accident; the men knew about sodium chromate, what it can do, and what to do about it. They recognized that they had been exposed and did what they had been trained to do—administer first aid, and get prompt medical attention. A happy ending? Yes, a very happy ending.

LEST WE FORGET

Ten years ago during removal of a Minuteman missile for recycle, a chip was detected in the ablative on the one/two interstage. Cause of the damage could not be determined.

Five years ago in a Minuteman launch control center, a team was performing maintenance which required isolation of the emergency environmental control system (ECS). During the isolation period, the normal ECS failed resulting in overheating of power supplies and approximately $3,000 in damage.

One year ago an Athena H vehicle was destroyed during flight by range safety. The cause of the accident was attributed to human factor in programming the on-board computer.

ACCIDENT PREVENTION—A TWO-SIDED PICTURE

As simple as it sounds, accidents are caused by deficiencies in material, people, or some combination thereof. Over the years the Air Force has developed well defined and highly effective means for handling material deficiencies. The same is not true for human deficiencies. You might ask, why is this the case? Part of the answer lies in the fact that it is often difficult to determine the exact cause of a mishap—human or material deficiency. Furthermore, when some doubt does exist, there is a tendency to relieve people of responsibility by giving them the "benefit of the doubt." We also have a difficult time in identifying the underlying cause of human failure. Was it the lack of adequate training, poor supervision, willful abuse, a well-intentioned shortcut, or an unexplainable blunder which caused the accident? Certainly we must be able to identify the reason for human failures before they can be corrected. Okay, people deficiencies are difficult to diagnose and correct. Nevertheless, they continue to be a major cause of accidents in the missile force. They also represent a lucrative target which could reap significant benefits for the Air Force. In short, we have a good handle on the material deficiency side of accident prevention. Now it's time to zero in on the human deficiency side! ★

OPS TOPICS

IMPROPER SPACING



The T-33 sustained damage to the left main gear door when it was struck by an approach end BAK 13 cable. The cable bounced when the T-bird nose gear rolled over it. The cable supports were spaced too far apart.

CLEAR

When a T-29 taxied behind a C-130 to take the active, the C-130 pilot requested that the T-29 call when clear. As soon as they heard the "clear" call from the T-29, the C-130 crew began engine runup. The prop blast caused flight control damage to the T-29. (The T-29 driver meant "clear to return to runup position" but the C-130 thought he meant "clear to runup.")

UNSEEN KILLER!

An Air Force officer and his family were killed when the light aircraft they were in crashed into the ocean. An autopsy showed an extremely high level of carbon monoxide in the pilot--high enough to totally disable him!

VHF RADIO FREQUENCIES



The following is from a recent Hazard Report. "While flying a GCA to a Naval Air Station using a VHF frequency, we were receiving two different stations, both broadcasting instructions with similar headings." There are limited VHF frequencies available to USAF/NAVY towers and GCAs. UHF has been designated as the primary USAF communications spectrum and USAF authorities recommend that aircrews use UHF whenever operating in congest areas in the continental US.

BACKWARDS TRIM



After takeoff the T-37 student pilot told the IP that th trim was running full up. The IP took control and made a landing with the trim stuck full up. The trim had bee wired backwards. That's why item 12 of the Electric Power On Checklist says "Trim: CHECK OPERATION."

CORRECTIVE ACTION



An allied forces mishap message stated that the accident was the result of pilot error. The pilot in the left se was copilot qualified and not authorized in the left sea He landed to one side of the runway and overcorrected. The aircraft left the runway and...ran into a tree. No one was injured. Corrective action: "The pilots have been fired."

F-5 FLAMEOUT

The pilot was the defender in an ACM engagement. He began a hard right turn to force the attacker to overshoot. When he felt he was successful he abruptly reversed the turn. Both throttles were in full A/B throughout both turns. Prior to completion of the left turn, the right engine stalled and flamed out. There was no mechanical malfunction. The probable cause was disruption of the airflow to the nr 2 engine (high side during the abrupt left turn.

OPS TOPICS

REE
RIMMING

The UH-1H pilot was maneuvering in a troop pickup zone when he misjudged the clearance available and struck a tree with the main rotor blades.



ICOCHET

As the Hun pulled off from a strafe pass, the pilot saw fuel venting from the right wing. He had sustained ricochet damage even though he had not violated the cease fire or pullout limits.

OSE
ISCONNECT

After 30 minutes of flight, the student pilot displayed symptoms of hypoxia. During descent for landing he discovered that his oxygen hose was disconnected at the CRU-60/P connector. After he reconnected it the symptoms disappeared.



IZZY?

After 5 spin preventions and 4 spins, the student pilot in a T-37 complained of dizziness, tingling in the fingers and inability to concentrate. Postflight inspection of the student's equipment showed that his mask was improperly fitted.

VER-G

As the F-4 maneuvered behind lead on an ACM mission, he inadvertently flew through lead's jet wash and put 8.1 Gs on the bird. Postflight inspection revealed that the wing fold locking lugs were cracked (one was completely severed).

IGHT SPOT

The UH-1 pilot was maneuvering in an LZ when the main and tail rotor struck the trees causing minor damage. The IP on board did not realize that the aircraft was drifting toward the trees until too late.



HAT
HE IP
EALLY
EANT...

The instructor told the student pilot attempting a landing in a Cessna 150 that the aircraft attitude was too nose-high and to release some back pressure. The student did and the aircraft impacted the runway nose gear first. The gear collapsed and damaged the prop.

IRST
HINGS
IRST

The Air Force lost the crew and a valuable aircraft recently when the pilot forgot the basic rule for coping with an emergency. Maintain aircraft control! The pilot, distracted by the emergency, allowed the aircraft to stall and then crash while setting up for a landing.



LIPPERY
IDE

The B-52 landed on a wet runway. The drag chute jettisoned immediately on deployment. Braking action was nil and the IP confirmed hydroplaning. The aircraft finally stopped 10 feet short of the overrun 45 degrees off runway heading. Seven main gear tires had failed.

LIBRARY U. OF I. URBANA-CHAMPAIGN

SAVE THAT JUNK

LT COL RICHARD G. WEBER, Directorate of Aerospace Safety—Photos Courtesy San Antonio ALC

Lately we've had a number of calls from frustrated safety officers who lamented: "The failed part was lost and now we can't determine the cause of our problem!" It seems that EUMR exhibits have always presented headaches. The folks who are interested in preserving evidence have done everything possible to streamline the system and to tell maintenance, safety and supply troops the reason failed parts must be retained and studied. Why, then, do we continue to receive gripes from all quarters?

The answer is simple. People normally expect that a system, once established, will function automatically. When the desired results are not achieved, the cry is apt to be to change the system rather than police it. Maybe the same individuals who want the system changed were not helping to make the present one work.

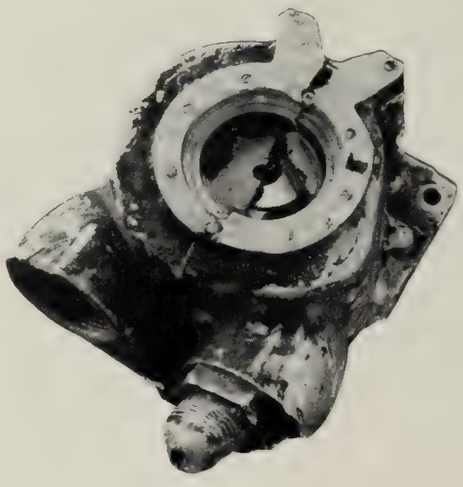
There are several causes for the continued loss of exhibits. Through misunderstanding, they may not be held until instructions are received; EUMRs may be sent to the wrong SM; the part may be lost in shipment; and the part may be lost in the ALC by getting into reparable parts channels. If the evidence does not get to the experts, it cannot be evaluated and a TDR does not result.

We've also been told that there is a tendency on the part of some individuals to withhold evidence because it may reflect unfavorably on the unit. Unfortunately this attitude may reflect even more unfavorably on the safety of the next pilot who encounters the same problem.

Everyone involved in the total process must, first, be aware of the correct procedure and, second, conscientiously follow it to the letter.

What are the rules and where can one find them? Complete information is near at hand in AFR 127-4 and TO 00-35D-54.

These procedures have evolved over the years as the result of processing countless materiel deficiencies from accidents and incidents.



Perhaps there is still room for improvement; however, we must remember that even the best plans can go awry if they are not tempered with good judgment. For instance, TO 00-35D-54 requires UMR exhibits to be held for disposition instructions or 30 days, but common sense would dictate followup action if the air logistics center (ALC) doesn't respond within a reasonable time. The absence of any ALC comment probably means there has been a foul-up in communications since they are obligated to respond with shipping or disposition instructions within five days after receipt of the Unsatisfactory Materiel Report.

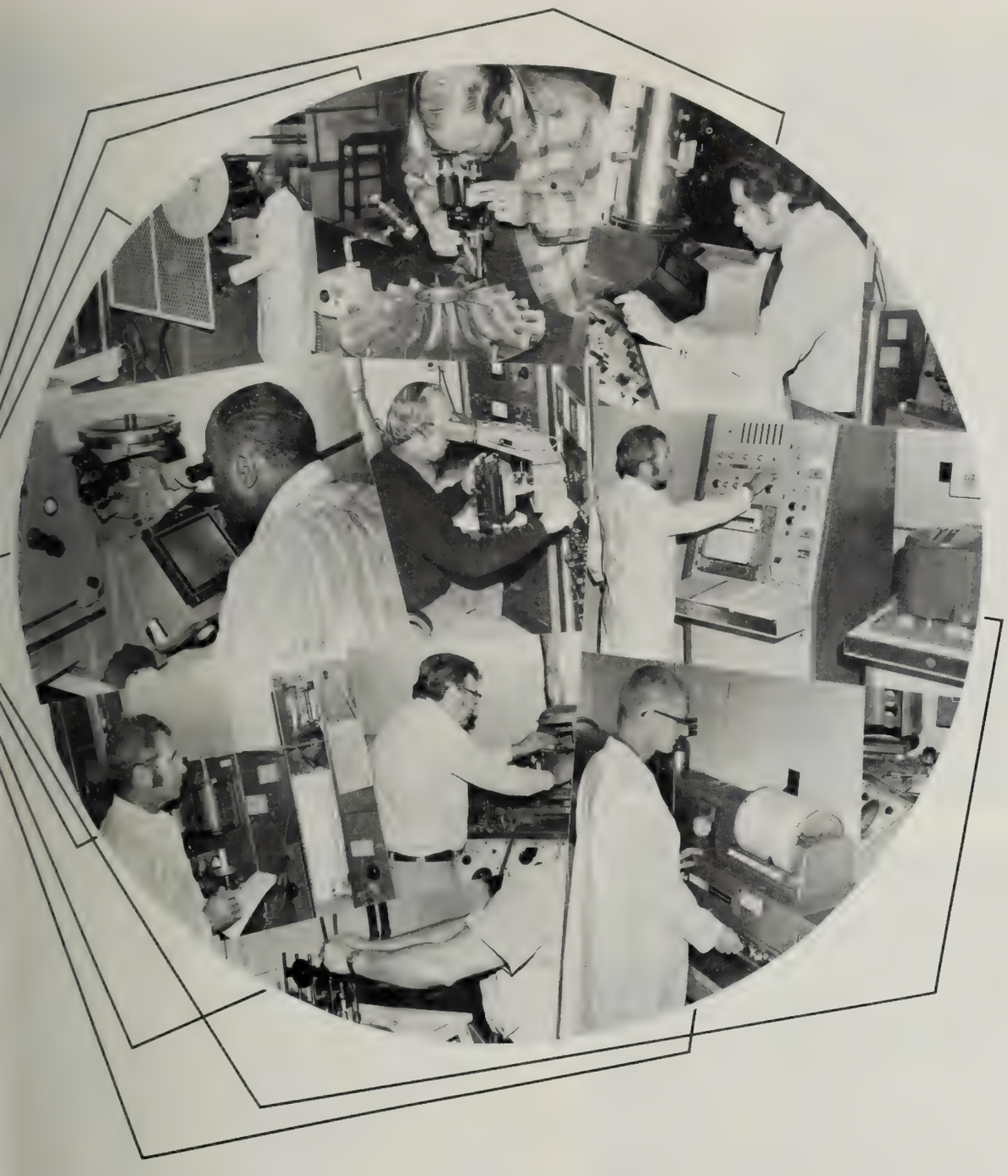
I called an ALC Materials Lab to see if they had anything to add to this article. Here's what they said. *Tell people to not destroy the evidence!* Some people can't wait for the professional investigation to find out why something failed so they examine the part themselves. Accident investigation boards have unwittingly destroyed evidence this way. Remember, you may not have the equipment or know-how to perform a complete teardown. You can bet the ALC will be more receptive to performing a modification if they have hard evidence to justify it.

The ALC personnel offered other useful tips. For example, actuators should not be picked up or handled by the rod end. The length of the rod should be marked to indicate how far it was extended when it was removed from the aircraft. Do not contaminate or damage a fractured surface, it contains valuable evidence. Field investigators should avoid the temptation to mate the two halves of a failed part.

EUMR exhibits should be labeled properly so the part or component does not get mixed with normal supplies at the ALC. If items that contain explosives charges are not properly labeled as EUMR exhibits, the explosives components are routinely removed when the part arrives at the ALC. This could destroy evidence. A call to the ALC with the control number and an estimated arrival time will alert them to watch for the part.

When a failed or damaged part is turned over to supply for normal packaging and crating, the evidence is sometimes destroyed even though they follow the proper technical or-

Technicians at AFLC labs use latest instruments to determine if and why a part failed, hence importance of EUMR exhibits.



ders and use the original containers. The ALC representative suggested the shipping organization contact the equipment specialist in the Item or System Management division to get specific packing and crating instructions before sending such an exhibit. Bell cranks, for example, should be packed in soft material to prevent further damage.

Lives have been saved from the study of failed parts. A classic case was generator failures in the F-100. The generators were disintegrating in flight and the fragments got into the J57 engine and failed it also. The prime ALC tried to duplicate the problem to determine the exact failure mode. They ran generators continuously, they cut off cooling air, they introduced FOD and the generators didn't fail. One day a UR exhibit arrived; the back plate which supported the armature shaft was loose. It was determined that the back plate failure was caused by a specific frequency vibration common to that area of the engine in flight. The back plate was redesigned and the problem eliminated. It might have been considered junk to you and me, but that one failed generator provided the key to the fix that prevented subsequent failures.

Let's make the system work. ★



TWIST, STRAIN and PAIN LOADING airplanes



MSGT WILLIAM H. WEAVER
Directorate of
Aerospace Safety

Today Air Force cargo loading is a smooth running, efficient and, for the most part, mechanized operation of which safety is and must be an integral part. The Air Force's most valuable asset is its trained workforce; training is the mainspring that makes the whole clock tick. Today air cargo operation has come a long way from those days of a few carts, a glue pot, a couple of "Jack-of-all-trade" agents, a few pry bars, and a lot of manual labor. Today's air freight terminal is a 24-hour-a-day complex of hundreds of highly trained employees using special equipment to load almost any size and shape of cargo.

However, in spite of modern advances such as special pallets, conveyors, K-loaders, and other special cargo loading and freight processing equipment, the human element is still very much involved and injuries occur when safe procedures are not followed or equipment is not properly used.

Many injuries result from the pressures of meeting turn-around schedules, limited crews, and lack of proper equipment. Workers can become fatigued quickly working inside an aircraft because of poor ventilation or extremes of temperature and humidity. However, most accidents are caused by the unsafe acts of the person directly or indirectly involved with cargo handling. Some loading, unloading, packing, and shifting of cargo inside and outside the aircraft as well as at the cargo dock must be done by the strength and leverage of manpower; but, in most cases manual lift trucks, pry bars, hand pallet trucks or other manual lifting aids can be used and many injuries avoided.

Cargo handling has many inherent dangers. A loose object on a container can cause a fatality or serious injury when it falls on an unprotected head. Many sprained ankles occur when feet slip between deck board and pallets. When moving freight from a cart to a pallet, workers who twist their body rather than pivot by moving their feet frequently incur serious strains. Hands, fingers and legs are frequently mashed, cut or bruised because workers get caught between a pallet already locked into place and one being loaded. Injuries can occur during off-loading when an individual is caught between a moving pallet and the material handling equipment (MHE). Many injuries occur because cargo

handlers wear rings and other jewelry which gets caught on protruding nails and bolts. Probably the most common injuries occur after the MHE has placed a pallet or container into position and the cargo loading personnel must push, roll and maneuver the cargo into the proper position for tie-down.

Serious injuries have occurred when freight tumbled out of containers which were improperly packed. Removal of a "key" box can dislodge a whole stack of cargo from a pallet or container. Cargo should always be unloaded from top to bottom. Workers should never turn their backs on a full cart, pallet or container after restraints have been removed.

Gloves and safety shoes are a must for any freight handler and special protective equipment may be needed when handling chemicals or other hazardous commodities. Packing labels provide warnings and handling instructions which must be strictly followed.

Back injuries such as low back strain or pulled muscles are among the most common injuries involved in materials handling operations. The first thing to bear in mind is that violent or strenuous activity is not a prerequisite to such an injury. Often a very simple motion or continual improper movement can strain your back.

Proper techniques should always be employed for manual lifting. A good rule to follow is, if the piece of cargo won't fit between your legs during a normal manual lifting stance you should get assistance. Regardless of the size of the object, if it is heavy or bulky, a "team lifting" effort should be employed or a mechanical device used.

One important factor in any lifting task is to be sure your footing is secure and that you have ample room to maneuver. Workers inside a cargo aircraft are at a disadvantage in this area because they are usually limited by space and a smooth flat surface. In this situation, a simple motion during an attempt to position a pallet by pushing or rolling it into the correct spot can turn into an accident. Sometimes workers must stretch or lean into an abnormal position to insure that locks are secure and tiedowns are correct. A small drop of oil or some moisture can turn this otherwise simple task into a pulled muscle.

Many back strains which occur inside aircraft could be avoided by using roller pry bars or hand pallet trucks. Since there are no published technical orders covering their operation, the following checklist may prove valuable to put these mechanical aids to use safely and efficiently. Pry bars are particularly helpful in positioning heavy cargo; however,

Final check of tie-downs to insure cargo is secure. Airman at right removes boxes not secured by tie-down straps. Loose cargo has caused injuries, aircraft damage.







Improper technique—during pallet breakdown, boxes not tied together could slide off forklift and injure man at right.

care should be taken when using the pry bars under heavy objects, to insure that maximum allowable floor strengths are not exceeded. To determine wheel loads on wheels of pry bars the formula to be used is

$$\frac{\text{wt. of cargo}}{\text{roller contact area}} = \text{load per sq ft in pounds}$$

Aircraft technical orders should be consulted to determine maximum allowable floor loads. If any load exceeds the published limits, 1 x 12-inch shoring or other specified precautions should be used to prevent damage to the aircraft.

ROLLER PRY BAR CHECKLIST

1. Do not straddle bar to depress.
2. Watch hands on pry bar for scraping against sides and ceiling of the aircraft or on other objects.
3. When there is room for only one bar, use two men to control it.
4. Be careful of tie-down holes in the floor; they can cause the bar to swing out of control.
5. Check floors for proper stress, weights and distribution of cargo.
6. Check pry bars for cracked handles, broken wheels, worn parts, and metal slivers.
7. See that axles are greased and oiled.
8. Use two bars when needed on heavy loads.
9. Guide cargo carefully to prevent damage to internal areas of aircraft.
10. Do not exceed rated capacity of the pry bar system, or rupturing of the aircraft's hydraulic lines may occur.
11. To determine whether shoring is needed when pry bars or pallet trucks are used to move high density cargo, use the pry bar wheel weight formula. If the result is 200 pounds per square foot or more, the main cabin floor stress maximum is probably being exceeded and shoring must be used to prevent damage to the aircraft. Applicable technical orders and dash-2 and 9 handbooks must be consulted for specific data limitations. ★



CORROSION:
A BILLION DOLLAR WASTE



MR. WILLIAM A. THOMPSON, Warner Robins ALC GA

When the Klaxon didn't sound at the O' Club and the lieutenant missed the alert exercise . . .

And the captain's alert vehicle wouldn't start . . .

And a landing gear collapsed on the first aircraft at the turn out of the parking spot . . .

The commander knew he had some serious problems. An inquest the next day revealed:

The Klaxon didn't sound because corroded wires had finally failed. The broken ground wire to the battery (because of corrosion) put the alert vehicle out of business. The landing gear failed due to a stress corrosion crack.

Corrosion is a natural phenomenon that affects each of us in the Air Force today, although its effect on us can vary. A vehicle may not start due to corroded battery cable connectors; an aircraft may not be able to fly due to severe corrosion damage to structural members; an AGE unit may not operate due to a corroded component; a piece of electronic equipment may not function due to a corroded contact or switch.

To put the corrosion problem in proper perspective, consider the cost of corrosion to the Air Force—this figure represents both direct and indirect costs, such as manpower in corrosion facilities, engineering and staff personnel, nonproductive downtime, construction and use of corrosion facilities, data, training, and the materials involved in corrosion prevention and control.

There are some costs which at first may not appear to be corrosion related—cleaning of aircraft, missiles, and equipment; man-hours required for inspection, removal of equipment and panels to allow inspections; chemical treating, priming, and painting of metals and alloys; and the cost of safety equipment required for the various corrosion prevention and control operations. It is evident that an organized, coordinated effort is required to combat corrosion and reduce its effect on Air Force systems and equipment.

The approved unclassified nickname RIVET BRIGHT has been assigned to the Air Force Corrosion Prevention and Control Program. RIVET BRIGHT highlights and identifies, to all levels of command and management, the insidious nature of corrosion, its impact on the Air Force, and efforts to eliminate it through effective prevention and control methods.

In the past, much emphasis has been placed on control of corrosion. This implied that corrosion must have occurred before controlling actions could take place. Now the emphasis has shifted from corrosion control to prevention and control. Instead of simply controlling corrosion that has already occurred, we are after a more effective mixture of preventing as much corrosion as we can and then controlling that which cannot be prevented. This change to a prevention philosophy is reflected in the recently revised AFR 400-44. The upcoming revision of the AFLC Supplement to AFR 400-44 will further expand the philosophy of corrosion prevention.

A primary example of implementation of the corrosion prevention philosophy is formation of Corrosion Prevention Advisory Boards





L to R A1C Richard C. Parham masking in preparation for priming and painting. Sgt Edward W. Dawkins applying a protective coating to a KC-135 main landing gear.

(CPAB's). CPAB's presently exist for the C-5, the B-1, the F-15, the A-10, intercontinental ballistic missiles, and the advanced medium STOL transport (AMST). The CPAB members act as technical consultants to the designers and the system program office (SPO) for corrosion protection, material selection, and coating systems. CPAB's are composed of representatives of the SPO, the Air Force Materials Laboratory, the AFLC Corrosion Program Management Office, the prime Air Logistics Center, and the using command. One of the many advantages of CPAB's is that corrosion prevention can be introduced early in system design. Corrosion engineers can influence the selection of materials and finish systems and arrive at optimum "trade-offs" based on sound scientific principles.

In the past magnesium alloys were often substituted for aluminum alloys to reduce weight, with little or no consideration given to their increased corrosion susceptibility. Today, designers would probably use more corrosion resistant aluminum alloys, even though some increase in weight would result.

It is important that systems be designed to perform their assigned missions at the lowest acceptable cost, but consideration must be given to supportability and maintainability throughout the system life. The time spent by a corrosion engineer during the design phase of a system will pay large dividends due to decreased corrosion deterioration.

The causes and types of corrosion, as well as the severity, depend on many factors—the metals or alloys involved, surface treatments and finishes, environmental factors, and maintenance practices. Although the present emphasis on prevention will reduce the amount of corrosion we have to control on new systems, what about some of the older systems which did not have a CPAB to influence their design? On those systems, the Air Force must perform corrosion control in order to ensure operational readiness.

The corrosion "control" effort is a joint responsibility of AFLC and the using commands. The Service Engineering Division at AFLC Headquarters is the office of primary responsibility for the AFLC Corrosion Prevention and Control Program, and they have assigned management responsibility to the Warner Robins Air Logistics Center (ALC), Service Engineering Division. The AFLC Corrosion Management Office at Warner Robins ALC provides program direction, engineering and technical guidance to all AFLC activities.

The AFLC Corrosion Management Office effort emphasizes *information, data, technology,* and *assistance.* The information activity includes publication of a corrosion summary, which is published quarterly and is intended for use by all Air Force personnel performing corrosion work. It disseminates current non-directive corrosion related information, including evaluation of new materials, techniques, and equipment; status of changes in technical data; notices of corrosion training courses and symposia; status of major projects; and other corrosion oriented items. The summary is also provided to the Army, Navy Coast Guard, other US Governmen agencies, and allied governments.

In the data area, the objective i to improve the methods for obtain ing data relating to corrosion pre

vention and control action. At present, only the AFM 66-1 maintenance data collection system can provide a status of corrosion problems and actions that are incurred during service. In order for the information obtained from this system to be useful in predicting corrosion problems and trends, maintenance records must be accurate. Many times, corrosion induced malfunctions are reported as some other category of failure and are thus "lost" for analysis and study by corrosion engineers. It is imperative that all maintenance personnel recognize and report corrosion induced malfunctions correctly. Accurate reporting of corrosion problems is one of the best ways the operating commands can assist in determining the overall impact of corrosion deterioration on the Air Force.

Another data effort involves providing system peculiar corrosion manuals for new systems and for the more critical older systems. This manual, known as a dash 23, is designed for a specific weapon system and is used in conjunction with the general series TOs for cleaning and corrosion prevention and control. Corrosion manuals are also available for some specific classes of equipment. The data effort is not limited to aircraft systems but also applies to missile systems, aerospace ground equipment, and vehicles.

The technology program involves technical advancements in materials, facilities, and techniques. One of the major efforts is project PACER LIME. The purpose of this project is to classify the corrosion severity of the environment at each Air Force Base. This classification is necessary in order to assure a dynamic corrosion program and to allow commanders to schedule aircraft inspection and washing cycles based on local environment and operating requirements.

The assistance area is where most of AFLC's emphasis is presently being directed. The primary objective is to strengthen the corrosion programs of the using commands. One effective method is to properly train personnel. All maintenance personnel should be able to detect and properly report any corrosion deterioration encountered. Not only must corrosion shop personnel be current in their field, but adequate training courses should also be available in the sheet metal shop, motor pool, AGE shop, and flight line personnel.

Another facet of the assistance effort involves command corrosion prevention and control program surveys. These are performed by teams composed of AFLC, AFSC, and using command personnel. The team provides immediate assistance to command corrosion personnel, and makes recommendations that will ultimately improve the command program. These surveys result in assignment of specific action items to proper agencies for resolution. Results of these recommended actions are provided to the command corrosion monitor to enable him to better manage his program.

The final aspect of the assistance program is a continuing effort to emphasize the importance of the corrosion problem and the methods available to combat the problem. A training film stressing the importance of corrosion prevention and control is now available. TF-6656, entitled "An Ounce of Prevention," does not include technical details of corrosion treatment, but it emphasizes the fact that all personnel working on or around Air Force systems and equipment should keep their eyes open for corrosion.

The Air Force must continue to have an effective *corrosion prevention* and *control* program and that effectiveness depends on the cooperation of all personnel. ★

Left TSgt Francisco Morales checking tolerances in TO 1C-135(K)A-3-4, Corrosion Control: Prevention, Detection, Treatment and Repair Instructions. Right A1C Parham spraying protective coating on KC-135.





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TECH TOPICS

two is not better than one



Five minutes after takeoff number two engine fire warning light on the KC-135 illuminated. The mission was aborted and the engine shut down.

The day prior to this incident the nr 2 engine pressure dump valve was discovered leaking and was removed and replaced. During troubleshooting the engine fire light, it was discovered that the new pressure dump valve was leaking at high power settings and fuel had ignited in flight. Further investigation revealed that when the new valve was installed the old O ring seal was not removed and the new O ring was installed back to back with the old, causing the leak at high power settings.

pencil whipped



After the F-4 leveled off, the throttles were retarded out of afterburner but the right AB would not shut down. Throttle movement had no effect on afterburner operation. The aircraft was returned to the holding pattern with the speed brakes extended, and left engine at idle. After all other attempts failed to terminate AB, the engine was shut down and a single engine recovery accomplished.

Maintenance investigators found the throttle crossover shaft broken, and the engine showed evidence of excessive vibration. Several first stage turbine blades had broken and damaged the turbine section and frame. Also, the torque booster, BLC ducts, brackets and clamps were found damaged.

Review of the aircraft records revealed that TCTO 2J-J79-1174 had been signed off as completed, although the TCTO had not been accomplished.

whoa! I hope?



As he approached the entry control point, the refueling vehicle driver attempted to slow down and show his badge. He discovered that the accelerator on his R-5 was stuck full open. The sergeant exited the security area and managed to guide the vehicle to an open area where he began driving in a circle trying to stop the engine. He contacted his supervisor by radio. The supervisor and a vehicle maintenance man arrived and after chasing the truck on foot managed to jump aboard and remove the positive battery cable. Then when the ignition switch was turned off the engine started to diesel and finally died.

The accelerator return spring had failed allowing the throttle to go full open.

wrong way



Postflight inspection disclosed that the top and bottom of the right outboard skin on the T-37 wing was buckled as if the wing had been pushed apart vertically from the inside. Teardown of the wing disclosed that the fuel cell liner panels were also distorted and pushed outward. Disassembly of the outboard fuel cell revealed that the check valve between the outboard and mid-span wing interspar cell had been installed backwards, allowing the fuel to flow to the outer cell instead of preventing it from doing so as designed. Fuel flowed from the mid-span cell into the outer cell because of centrifugal force generated by normal and accelerated spins accomplished during the prior mission. This additional fuel expanded the outer cell, causing the wing panels to buckle.

ice is for drinks- not engines



An engine trim crew was running the engines on an A-37 at about 85 percent. After 10 minutes of operation they felt a slight vibration and shut down the engines. Ice was then discovered in the number two inlet screen. Seven first stage compressor blades were damaged enough to require replacement. The temperature was 32°F and the dew point 32°F also. This allowed engine icing to occur without any signs of external icing.

how to stage an explosives incident

The maintenance crew was dispatched to do a jettison check on an F-4. During this check the centerline tank was jettisoned.

There were **five** separate tech data deviations leading to this incident.

1. After a cross-country flight, OMS personnel removed the centerline tank without having the aircraft dearmed.

2. MMS personnel subsequently armed/dearmed the aircraft **several times** without checking to be sure all cartridges were removed.

3. Immediately prior to the incident OMS personnel installed the centerline tank without making sure the cartridges were removed, or installing the safety pin.

4. The MMS crew involved in the incident did not make sure the aircraft was dearmed or that safety pins were properly installed.

5. The number two (cockpit) man of the MMS load crew used the emergency stores jettison button instead of the wing and centerline jettison switches, as required by T.O.

for the want of a SOAP

The WC-130 was returning to its TDY base when the nr 1 low oil quantity light came on. The oil pressure gauges were fluctuating violently from near zero to normal pressure. The crew shut down the engine and made a three engine recovery. After the bird landed, maintenance found the turbine section filled with oil caused by failure of the gear box oil pump.

The engine had been showing an unfavorable trend in iron content on SOAP analysis. The SOAP lab had requested red cap samples after each flying day. The crew chief misunderstood the SOAP request and made an incorrect 781 entry. As a result, when the aircraft went TDY no SOAP samples were taken. The aircraft flew 41 hours from departure at home station to the incident.

overtorque

During an FCF on a T-38, the nose gear failed to extend and lock with the alternate release system. The normal system was tried but failed to extend the nose gear. Positive G-loads and yawing the aircraft had no effect. The left engine was shut down, hydraulic pressure depleted, and again the alternate release pulled IAW the checklist. Positive G-loads then resulted in a safe down and locked indication.

The left engine was restarted and the aircraft returned to base without further problems.

The nose gear drag brace apex bolt and nut were found overtorqued, which caused the gear to bind during extension.

bent then broken

The T-37 was practicing gear down maneuvers at altitude when the hydraulic pressure went to zero and hydraulic fluid was blown from the nose gear downlock door onto the windscreen. The pilot was able to land despite extremely poor visibility through the fluid. The speed brake selector valve line had cracked under pressure. This crack developed because someone bent the line and overstressed it. When you do maintenance in an area around pressurized non-flex lines, be careful not to bend or warp them. Such bends can and have caused overstress failure.

without wings

During preflight of a T-38, the instructor pilot noticed a quarter-inch gap between the wing and fuselage. He had the crew chief remove the 15 percent wing spar attachment bolt inspection panel and the spar attachment bolt was found laying inside.

The bolt showed no sign of wear along its shaft that would indicate it was installed and later worked out. The bolt and nut plate threads were normal.

The last maintenance performed in this area was during a 400 hour phase. The work card requires that the 15 percent spar attaching point be inspected for cracks, shifted bushings, retainer rings for security and proper alignment of slippage marks.

throttle rigging

In two days there were three separate cases of engine failure caused by improper throttle rigging. Fortunately, none of the failures caused an accident. In each case failure to follow tech data and inadequate supervision were the culprits. With our ever-tightening budget restrictions, we just cannot afford to waste money on careless or shoddy work.

panels, panels and more panels

Every day more messages flow into the Safety Center telling of panels lost in flight. Very, very seldom is a panel lost from material failure alone. There are almost always the contributing factors of failure to secure the panel properly and failure to check it by both maintenance and aircrews.

The loss of a panel can have serious consequences. Recently a lost panel caused a minor accident which could very easily have been a major one. We must stop these losses.

how's your conscience?

The following is a quote from an EUMR generated by an aircraft incident.

"Analysis of rudder/brake pedal in the cable pulley area revealed no material deficiencies. The failure was due to overloading outside the designed limits. Deep gouges and scratches in the area of the break indicate a prying action which fractured pulley sides, and breaks occurred when designed loads were applied. There is no way to determine when or by whom the scratches/gouges were produced."

the job isn't finished until you pick up the pieces

The T-37 was on a go around when the number one engine flamed out. The engine failed because a two-inch piece of copper wire lodged on the electrical terminals which control the fuel shut off T-handle valve. The short circuit caused the valve to close. This kind of wire is used only to safety the personnel lead connectors behind the ejection seats.

it was not the right nut!

The T-37 pilot lost control of the nr 2 engine. He could neither advance the power above 65 percent nor shut down the engine. The wrong locking nut was installed on the throttle clevis. This nut backed off and let the bolt back out, disconnecting the throttle linkage from the main fuel control.

This time it was only an incident but in 1973 the same error caused a major aircraft accident.

a little chafing can be dangerous

The navigator on a C-5 saw a bright flash and some sparks falling from behind his left overhead circuit breaker panel. Although no equipment failed nor did any circuit breaker open, there was evidence of some burning on the main AC feeder lines. A more thorough investigation after landing revealed that the rubber protective grommets were loose or missing from the eight main AC feeder lines where they pass through the crew stairway. The bare metal wore through the insulation causing sparks. Four more aircraft at that base had the same condition!

hose in the hose

Three low approaches and two touch and go's had been completed in a T-33. On the next time around, when the gear selector was placed down, only the nose and left main went down and locked. The extended gear was retracted and the emergency system activated, to no avail. After all attempts to lower all three failed, the runway was foamed and the aircraft landed gear up.

After the aircraft was removed from the runway, the gear could be extended only after the up line was disconnected. The resistricto in the up line was inspected and a piece of rubber hose materia was found in the restrictor, block ing the return port. This was the third flight since phase inspection during which time both hoses were replaced. ★

Advertisement For Life Support Equipment



: Don Cook
mber Pilot

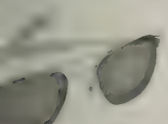
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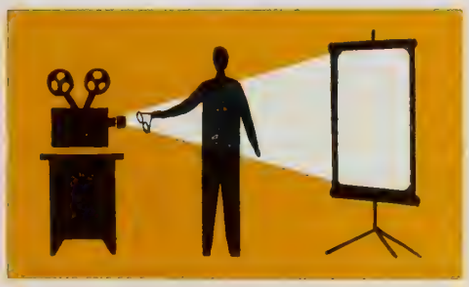
ıy do these pilots, flying different aircraft, see things the same way?

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MAIL CALL

Potential FOD

1. I am amazed by the things found in aircraft that don't belong. The 132d TFG just found another "incredible." During phase 1&2 on F-100D-86-NH-56-



3462, "bucking bar" (see above photo) was found laying loose on the lower skin of the aft section above door F121. This is immediately below the control linkage for the stabilator actuator. This was the first phase inspection on this aircraft since it was received from another unit.

2. Several months ago a much smaller part was loose in this area and almost cost one F-100. Fortunately we found this bar before a mission involving negative g's was flown such as a functional check flight or air combat maneuvering mission.

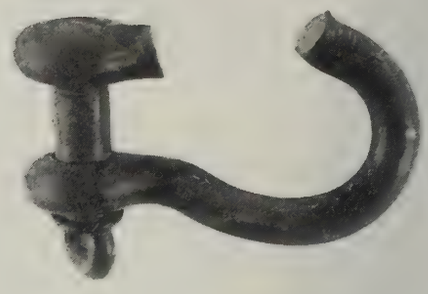
3. Tool inventories are supposed to prevent these situations, but obviously they don't. Perhaps a requirement for "high visibility" should also be included for tools. Chrome plating, white reflective paint, etc., might help the inspector spot forgotten tools.

4. Please feel free to use this situation for another timeless article on FOD prevention.

JAMES M. FREDREGILL, Major, Iowa ANG
Chief of Safety
132nd Tactical Fighter Wing (TAC)
4200 S.W. 34th St
Des Moines, Iowa 50321

Thanks, Jim; another blow for FOD prevention through meticulous inspection and tool accountability.—ed

Equipment Damage



1. Enclosed are some photos of a clevis hook used for F-100 Aircraft engine run tie-down. This hook is attached to the dead-man anchor embedded in the concrete run-up area and secures cables attached to the aircraft. It normally remains in the run-up area with cables attached.

2. Some time ago, this clevis hook encountered a



shear force (Note damage in close-up of break area), causing a stress concentration. The last engine run encountered a "Hard" afterburner light (greater than normal thrust) and the engine was shut down immediately. The aircraft was disconnected from the tie-down cables and towed to the ramp area for engine adjustment. The next day, the hook was discovered broken on pre-engine run inspection.

3. The most probable cause is believed to be a monster snow removal machine attacking the hook last winter. Nicks and dents in the five pound hook probably seemed like fair wear and tear to the casual observer. Disaster would have resulted if another afterburner run were attempted immediately after failure of the clevis hook.

4. We were lucky . . . next time we will be smart. First, we remove cables, hooks and equipment from run-up area between engine runs, inspect all equipment for damage, then replace marginal equipment.

5. We thought a few other units might have a similar problem and you could help us spread the word.

FRANK R. O'NEILL, Maj, MI ANG
127TFGp Safety Officer
Selfridge ANG Base, MI 48045

Nicad Batteries

One point regarding NICAD batteries was not mentioned in the article (NICAD Batteries Aerospace Safety Magazine, November 1974)). If NICAD batteries are allowed to fully discharge, they probably will go into a "reverse polarity" situation and will become unusable. Therefore NICAD batteries must never be allowed to become fully discharged.

DONALD C. MACDONALD JR, Capt, USAF
Dep Chief, C-E Maintenance Division
3d Mobile Communications Group (AFCS)
Tinker AFB, OK 73145 ★

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Accident Prevention

Program.



L TO R Major
LARRY G. JAMES
Technical Sergeant
PATRICK Y. RIGGS
Captain
FREDERICK STOVEL

304th Aerospace Rescue & Recovery Sqdn (AFRES)
Portland International Airport, Portland, Oregon

On 3 March 1974 Maj James, Capt Stovel and TSgt Riggs were ferrying an HH-34J from Portland, Oregon, to Davis-Monthan AFB, Arizona, when the aircraft experienced a sudden pitch-up. The crew initiated immediate corrective action, without success. The aircraft continued to pitch-up to 60 degrees so Maj James rolled to a 70 degree bank. Both Capt Stovel and Sgt Riggs assisted Maj James in his efforts to establish pitch control. The aircraft had turned approximately 360 degrees and descended to 1000 feet above the ground when Major James rolled it out level and again experienced the same pitch-up. Although over rugged mountain terrain, with boulders and trees obscured by snow, Maj James noticed a small open spot in the timber below and placed the aircraft into auto-rotation as a last resort. He skillfully maneuvered the aircraft with the assistance of Capt Stovel on the controls to a safe landing, after avoiding a 60 foot tree directly in front of the aircraft prior to touchdown. The aircraft came to rest with but minor damage to rotor blades, which encountered scrub oak trees on each side of the forest opening. The only visible damage was confined to main and tail rotor blades. Loss of control forces was attributed to suspected failure of the primary hydraulic system.

The aircrew's application of immediate and positive action prevented what otherwise might have been a fatal aircraft accident. WELL DONE. ★

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TWIST, STRAIN & PAIN

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MARCH 1975 AFRP 127-2 VOLUME 31 NUMBER 3



MARK HUNTER
USAF SAFETY OFFICER

ve discovered there are two types of bases, those that are geared for ransients and those that are not. Some bases just don't get transient raffic. Like the old chicken-egg argument, is it because of poor services have the services been allowed to deteriorate because there is nobody use them? I think both factors come into play. It's certainly not cost ective to operate a 24 hour snack bar if there is no one to use it. I've wondered why some bases have been on the list a long time even ugh the people continually rotate. I think that once a good attitude vails at a base, it is passed on to the new arrivals. It takes a lot for that risma to be destroyed.

Just before Christmas we completed a Rex Riley evaluation at 13 es and I'd like to pass on some of our observations. Transient mainte- ce was generally good, unless they were swamped by a large number aircraft on the ground at the same time. (Manpower reductions have en their toll, so be patient.)

The cold weather caused some safety violations. One base attempted refuel us before our passengers deplaned and with power on the aircraft. fueling checklists were not used in most cases. At two bases the refuelers imed they didn't have to ground the aircraft if the grounding points were readily accessible because of ice and snow. Everybody else was prop- y chipping the ice and snow away to get at the grounds.

In addition we saw some violations that can happen anywhere: Air- ft being towed without wing walkers, SOAP samples taken with the ong size tube, so the oil had to be sucked out of the tank by mouth. (This dangerous because the oil is highly toxic if swallowed.) How's this for attitude case; a SOAP lab technician couldn't process our sample right ay because he was busy cleaning rabbits. Several TA people didn't make per entries in the aircraft forms. Some fire extinguisher hoses were in d repair. It wasn't all bad. We saw an excellent consolidated tool kit at nker AFB.

The food machines in Base Ops were usually pretty good except there s no convenient way to retrieve lost money.

The TAQs were generally fair. Valuable storage provisions were al- st nonexistent and one place didn't issue towels. One base posted the me of the maid in the room as a personal touch. The room *was* a lot aner.

The officer crew quarters were generally good. Some rooms couldn't darkened during the day and individual room heat controls were rare. iffiss modified their central heating system to allow individual heat con- l. Call them if you want to find out how they did it. Some bases still n't segregate aircrews from non-crewmembers. We found a family with all children billeted next to the crew quarters.

We talked to a lot of people about our publications and got some good dback. The Rex Riley Transient Services Award list, while strictly sub- tive, shows which bases we recommended. ★

THE

REX RILEY
Transient Services Award

CARSWELL AFB	Ft. Worth, TX
HOMESTEAD AFB	Homestead, FL
LORING AFB	Limestone, ME
McCLELLAN AFB	Sacramento, CA
MAXWELL AFB	Montgomery, AL
SCOTT AFB	Belleville, IL
McCHORD AFB	Tacoma, WA
MYRTLE BEACH AFB	Myrtle Beach, SC
EGLIN AFB	Valparaiso, FL
MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
MARCH AFB	Riverside, CA
GRISSOM AFB	Peru, IN
CANNON AFB	Clovis, NM
LUKE AFB	Phoenix, AZ
RANDOLPH AFB	San Antonio, TX
ROBINS AFB	Warner Robins, GA
HILL AFB	Ogden, UT
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, NC
ENGLAND AFB	Alexandria, LA
KADENA AB	Okinawa
ELMENDORF AFB	Anchorage, AL
PETERSON FIELD	Colorado Springs, CO
RAMSTEIN AB	Germany
SHAW AFB	Sumter, SC
LITTLE ROCK AFB	Jacksonville, AR
TORREJON AB	Spain
TYNDALL AFB	Panama City, FL
OFFUTT AFB	Omaha, NE
McCONNELL AFB	Wichita, KS
NORTON AFB	San Bernardino, CA
BARKSDALE AFB	Shreveport, LA
KIRTLAND AFB	Albuquerque, NM
BUCKLEY ANG BASE	Aurora, CO
RICHARDS-GEBAUR AFB	Grandview, MO
RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH

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compound emergencies



COLONEL JERRY SCHWENE
Directorate of Aerospace Safety

Stan, a friend of mine, had a compound emergency one night a few years ago. His story is not spectacular, but is typical of many others buried in the incident report archives. It does provide a basis for thought about compound emergency situations.

Stan and his C-130 crew were churning through the blackness over the South China Sea enroute from Clark AB to Tan Son Nhut. They had been level for about an hour and could see lightning flashing around the rainstorm build-ups below. They had settled in for a normal flight, each guy doing his job in an effective, routine manner, as they had done a hundred times before. Then the engineer reported an event, beginning two hours that were not routine at all.

"I've got a generator out light on number two—won't reset—no volts, cycles or load."

Out of the corner of his eye Stan had seen the light pop on, and the engineer switching and checking as he tried to get the generator back.

"OK, crew," Stan directed, "we're shutting down number two engine — FIRE EMERGENCY CONTROL HANDLE."

"PULLED," said the copilot as he checked that he had the correct T-handle and pulled it.

One, two, three, four—just like the book said—bold face and clean-up checklist completed.

"AC, this is the loadmaster, everything's OK in the rear, only one passenger woke up—SM-OO-OO-TH!"

Stan checked the instruments. The number one generator had picked up the essential AC bus as advertised.

With everything under control, Stan said, "Co, get us a clearance back to Clark; Nav what's my heading back to Lubang?"

At this point, Stan's crew was in pretty good shape. They had acted upon the single failure, the generator, in compliance with the flight manual. But we shall see, as events developed, an automatic response soon was not adequate.

They had just completed the turnaround and leveled at their clearance altitude near the three-engine ceiling, when the engineer moaned, "Sorry, Major, now I've got a light on number one generator and I can't get it back either."

"Did you reset it?"

"Yeah, a couple of times."

"OK, just a second," Stan said.

His mind was racing, thinking of his alternatives faster than it takes to tell them. The flight manual prescribed engine shutdown when a generator failed. But, he didn't know whether the failure of the first generator was caused by an electrical problem that had now failed the second generator, or if they were completely independent failures. If progressive, number three generator would probably go next since it automatically picked up the essential bus. On the other hand, even if the failures were completely independent, there was danger of fire or loss of the engine if the generator disintegrated. There were also other considerations. If he shut down that second engine, he would lose his utility hydraulic system and the hydraulic power for gear and flaps, his two engine ceiling would be down in the rainstorms and the Philippine terrain; and a night, weather, two-engine, no-flap landing was not at all appealing.

But, he had to make a decision!

At this time, Stan and his crew are faced with a multiple, compound emergency and there are several points that become apparent.

First, in a compound emergency situation there may not be a good solution to the problem. The choice to be made may be between lousy alternatives and the problem is in selecting the best.

Next, the human factors of experience, training, knowledge, judgment and self-discipline become very important if the emergency is to be handled. In Stan's case, he faced not only the two basic generator failures, but the problems of aircraft control, performance, and systems degradation. These were things he had to consider, but the key for a proper decision was almost entirely related to his knowledge and judgment in reaching the decision.

Another point is that the compound emergency, unlike the simple emergency, is not treated extensively in the flight manual or other publications. True, some flight manuals talk about the lights, instruments and systems lost during progressive electrical failure, but beyond that, there is little guidance. The proper handling of a compound emergency is linked to the completeness of the knowledge of the people involved.

Finally, when things are going wrong, somebody still has to fly the airplane. The files contain many examples of relatively straightforward emergencies which were not, in themselves, disastrous. But then, probably due to looking around, inattention or lack of proficiency, the pilot lost control of the aircraft.

Let's get back to Stan and his crew.

"We're shutting down number one," said Stan, his decision made. He switched off the autopilot and concentrated on flying the airplane, while they ran the checklist. After the immediate problem was solved, the whole crew went to work in earnest on their specialties, under Stan's leadership. He directed setting up engines one and two for air start.

"If anything else goes wrong, the generators won't matter," he thought, "I'll need engines."

The copilot ran the radios, obtained clearances, checked MEA's, flew or monitored the airplane when Stan wanted to look at or check something, and backed up the engineer and navigator with information and computations.

The navigator went to work vectoring them around the rainstorms, checking positions and track and terrain when they came over land. They all were relieved when he announced, "I've got a good radar fix on Lubang." The VOR needles hadn't locked on yet, and the ADF's were jumping around toward lightning flashes.

The engineer had figured two engine ceiling and mentally compared it with the copilot's announced MEA's. He told Stan his calculations for a fuel dump.

Stan, meanwhile was flying the airplane, coordinating the crew activities, and mentally thinking ahead to the approach and landing.

"Copilot, try to get the Clark and Manila weather and the forecasts for hour from now."

The loadmaster had told the passengers of the situation and got them into *Mae Wests*. He told them they were going back to Clark, while reminding them of ditching and crash landing procedures. He knew he'd have to crank the gear if it didn't freefall into down and locked. He'd ask about cranking the flaps when everyone wasn't so busy.

These previous paragraphs make the problem seem more simple than it was. Once the decision was made, the crew went to work.

Leadership was apparent. While space prevents a discussion of Stan's personality and personal attributes, he was an aircraft commander in the full sense of the term. And because he was, his crew responded to his decision. You can bet that, without confidence, they would have questioned shutting down the second engine.



In the Air Force, this commander/crew relationship and the resulting efficient communication and action are lumped into the words "crew coordination." A likely time for the breakdown of crew coordination is during a compound emergency. The confusion, fear and work overload in such a situation can lead to chaos—at exactly the time when precise communication between crewmembers is all-important.

If you've ever listened to the voice tapes of such a situation it becomes apparent: The crew can be working the emergency quite efficiently, when comments such as, "What's going on now?" or "You'd better get this SOB on the ground fast," begin to appear. While they reflect true emotions, they do not convey information and do add to the confusion.

Well, anyway, Stan's crew was efficient and effective.

After two hours of absolute concentration by all crew members, they touched down at Clark. As the aircraft stopped and the fire trucks surrounded it you could almost hear the sigh of relief.

After the loadmaster had unloaded the passengers, he walked over to Stan and with a big smile said, "Slick, Major, damn slick."

Now, it's difficult to fault success but Stan was criticized for a while for shutting down that second engine. In our private conversations he told me he wasn't too certain he had been right. The teardown reports helped. Both generators had

been white hot, disintegrating internally and on the verge of coming apart when Stan shut them down.

SUCCESS FACTORS

Stan and his crew didn't do too badly with their compound emergency. Let's summarize some of the factors that contributed to their success.

Personal attributes rate high on the list. While Stan was easy to get along with, there was no question that he was the aircraft commander. His character, knowledge and judgment were trusted by the crew, and they, in turn, responded with a good performance. They succeeded as a crew because they each, individually, had the desire to work, study and train to do their job in the best way they could. Their successful handling of the emergency began long before that first generator failed.

Personal preparation is a long term thing and then requires review to keep up-to-date. Study of only Section II and Section III of the flight manual just to pass examinations and check rides isn't enough. Stan and his crew had a thorough knowledge of aircraft systems, aircraft performance, emergency procedures; and Stan was a highly proficient pilot. When the emergency occurred they had a solid foundation of knowledge and skill. They were prepared.

Stan consciously used a planning technique that went one step beyond the common concept of mission planning. He spent a few minutes looking over the route, terrain and weather after the flight plan was finished. His mental questions probably were, "If things start to fall apart here—what do I do? Where do I go? What should I look out for?" Once again, this type of prethinking helps the judgment and decision making process under stress.



If there could be one boldfaced item for all emergencies, it should be: SOMEONE MUST FLY THE AIRPLANE. In some flight manuals we see it listed as "MAINTAIN CONTROL." Now, that seems too basic to mention, but there are too many accidents where the emergency did not really cause the crash —loss of control did. Stan flew the airplane; he wasn't gawking around the cockpit watching the engineer and navigator; he kept up with their progress through communication.

And that's what crew coordination is all about—effective communication leading to appropriate action. Stan's crew had a lot to think about and act upon, and they did it in an orderly, effective manner.

And so, if I had to sum up my ideas on what's important in handling a compound emergency, I'd say—pilot and crew. We can continue to press for design reliability, error-free maintenance and supervisory perfection; but, once the emergency occurs, it's the people on the spot who are the key. They've got a real-life test of their knowledge, leadership, decision-making and judgment. Oh sure, there may be time to get help from experts on the ground, and they should, but they're still the guys in the barrel.

One final point. We've talked about success decisions. There are some decisions and circumstances that are survival decisions. These include ditching, crash landing and bailout. In certain situations, the lousy alternative choice is survival. If that's the choice, make it while there is a chance for you to survive. ★

OPS TOPICS

SLICK LANDING



The two RF-4s diverted to an alternate due to weather. Lead made it on the first try. When nr 2 landed, there was a heavy thunderstorm at the departure end of the runway. The aircraft touched down in the first 1000 feet, but with a 16-knot tailwind. The drag chute had to be jettisoned because of weathervaning on the wet runway. Fortunately, the MA-1A worked as advertised.

UNPLEASANT SURPRISE



The F-100 pilot, scheduled as one of a four-ship gunnery mission had to abort his first airplane. After arriving at the range, the first two events were completed without problems. However, as he started the strafe event, the pilot noticed that the air conditioner did not seem to be operating and that fumes were present. He was becoming hypoxic. Although he selected "100%" and "emergency" on his regulator, the pilot did not get the anticipated increase in oxygen flow. Fortunately, the pilot was able to make a successful recovery despite gradually deteriorating performance. The investigators found that there were holes in the oxygen hose, which the pilot had missed because he rushed his preflight oxygen check. The air conditioner was inoperative because the emergency ram-air lever had been moved slightly out of the closed position. The pilot could not find the ram-air lever as a result of nonstandard placement of the switch and reduced pilot capability from hypoxia.

SHORT ROUND

The F-4 rolled in for a dive toss bomb run after two low-level deliveries. When the AC depressed the pickle button a practice bomb immediately departed the aircraft. The AC had left the delivery mode switch in direct--even though he had correctly responded when the WSO read the checklist.

BIRDSTRIKE



The RF-4 was on a low-level mission. While descending on the backside of a hill, the aircraft flew through a flock of 25-30 birds. Damage to the right wing was discovered on postflight.

TRIM FAILURE

A C-130 crew experienced runaway trim whenever they tried to trim either up or down with the normal system. The emergency system worked fine. The malfunction was caused by a short circuit of the trim switches in the pilot's elevator trim toggle switch. This short occurred because someone unscrewed the trim toggle switch and allowed the trim switches to twist inside the control column and then short out.

WRONG ROOST



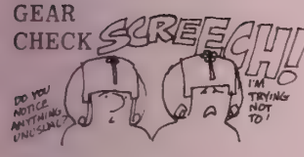
The pilot of a CH-53C on a night recce mission had descended for better ground visibility (800 AGL was the last reported altitude). He then made several heading changes and apparently a descent which went undetected until just prior to impact in the trees. Fortunately they made it home with minor damage.

OPS TOPICS

FOD (ALMOST)

As the T-38 was taxiing back to the ramp after landing, the IP in the rear seat had a page from his checklist blow out of the cockpit and into the right intake. The crew immediately shut down both engines. Fortunately, there was no damage even though pieces of the checklist page were as far back as the fifth stage of the compressor.

GEAR CHECK



On base leg the T-34 pilot was high, so he lowered full flaps. His attention, and that of the IP, was focused on altitude and airspeed. Neither pilot noticed that the gear was up until touchdown.

BIRD DEFENSE



The following is a quote from the 410th Bomb Wing CIF. "Twice in the past two weeks we have proven conclusively that our feathered friends pose a threat to safe flight. One duck and one crow have engaged B52s in aerial combat on OB-90 and met their just reward. Fortunately, neither chose to attack a windscreen. Damage in both cases to the leading edge of the wing indicates that F=ma, and damage should be expected if the bird chooses to try a windscreen. Since no stern attacks have been attempted, our Defensive team has been unable to provide any assistance. The best defense so far appears to be heads up and visor down. The pilot, copilot and occupant of IP seat shall use their visor during low level until the birds get the word and cease their attacks or at least until the fall migration to warmer climate is over." Ditto for the spring migration.

WILD RIDE

A student pilot was on his initial solo in the T-37. His final landing was made on the 6200-foot runway with a 4-knot tailwind. He commenced moderate braking with 1500 feet remaining. Shortly thereafter, the aircraft began to skid and swerve from right to left and back. During the second abrupt left turn, the right main gear downlock over-center bolt failed. This allowed the right main to collapse; subsequently the aircraft ran off the runway. The student pilot had failed to recognize the increased ground speed during landing and then did not use proper braking. Also worthy of note: after he left the runway, the student pilot jettisoned the canopy without attempting to use the emergency electrical canopy switch. He did not install his ejection seat pins nor did he turn off the generator or battery switches.

SURPRISE!



The T-37 IP was demonstrating a loop. Everything was normal until the airplane was going straight up. Then the IP realized both engines had quit. He then coolly lowered the nose and restarted the engines. The cause of the flameouts could not be determined.



RADAR VECTORS AND OBSTACLE CLEARANCE

Use of the radar vector is the simplest and most convenient way to position an aircraft for an approach. Air traffic controllers, through the use of radar vectors, can position an aircraft at almost any desired point in controlled airspace while providing obstacle and air traffic clearance. Vectoring is normally given to enable aircraft to complete a segment of a published route or instrument approach procedure. Due to a recent FAA interpretation of "Cleared for Approach," the following questions and answers will hopefully clarify what is expected of Air Force pilots.

Q: If a pilot receives radar vectors to intercept a published straight-in approach procedure and is subsequently cleared for the approach, can he descend to the FAF altitude?

A: No. A recent FAA NOTAM states: "An air traffic control clearance is not authorization for a pilot to deviate from any rule, regulation, minimum altitude, nor to conduct unsafe operation of his aircraft." Therefore, clearance for the approach is *not* authorization to descend below *any* minimum safe altitude (including assigned radar vector altitude) until established on a segment of a published route or instrument approach procedure.

Q: What obstacle clearance am I being provided by maintaining the last assigned vector altitude until established on a segment of a published route or the instrument approach procedure?

A: The minimum radar vectoring altitude assigned by the air traffic controller will assure you of a 3 nautical mile lateral separation (5 NM if the obstruction is beyond 40 NM from the radar antenna) and/or 1000 foot altitude separation from any obstruction until established on a segment of a published route or instrument approach procedure.

Q: I am on a radar vector to intercept a segment of a published route (e.g., NoPT route or TACAN arc) and then cleared for the approach. When may I depart my assigned altitude?

A: Maintain your last assigned altitude until established on the published route, then adhere to all depicted altitudes at or below your last assigned altitude, (reference FAA General NOTAM, 28 December 1974).

Q: If I am being radar vectored to a segment of an instrument approach procedure *below* the minimum safe altitude and am subsequently cleared for the approach, should I climb to the minimum safe altitude?

A: No. Do not climb back to the minimum safe altitude due to possible conflict with higher IFR traffic (reference FAA General NOTAM, 28 December 1974).

Q: I am being radar vectored for a straight-in instrument approach procedure at the minimum safe altitude, which is well above the final approach fix (FAF) altitude. I am cleared for the approach. What Should I do?

A: Maintain your last assigned altitude until established on the instrument approach procedure, then adhere to all published altitudes at or below your last assigned altitude. However, the possibility exists that the altitude-to-lose versus the distance-to-go may require an excessive rate of descent. If this occurs, the pilot should request clearance for either a holding pattern or a procedure turn (if published) to lose excessive altitude prior to the FAF.

Q: Is there a specific point on an instrument approach procedure to which an air traffic controller will attempt to vector me for an approach?

A: No. The flexibility of radar vectors allows the controller to vector you to intercept an instrument approach procedure at almost any point from the IAF to the FAF. Any assigned vector should place you in a position to intercept the instrument approach procedure prior to the FAF at a reasonable intercept angle.

Q: I am being radar vectored to an instrument approach procedure depicted by a procedure turn. How far out does the "published" instrument approach procedure extend since the barb symbol is obviously not drawn to scale?

A: The instrument approach procedure in this case can be considered to be published from the procedure turn fix to the "remain within" distance shown on the instrument approach procedure. Once within this distance from the procedure turn fix and established on the published inbound approach course, you are assured of obstacle clearance and can descend to the next appropriate altitude.

REMEMBER:

- Radar vector procedures vary according to circumstances within each terminal area. If there is a question about your assigned altitude or route, do not hesitate to ask your controller.
- Regardless of where you join the instrument approach procedure, maintain the last assigned altitude until established on a segment of the instrument approach procedure, then use DME, crossing radials, or radar to accurately determine your position and comply with all course and altitude restrictions at or below your last assigned altitude.

In summary, after being cleared for an approach, do not depart your assigned altitude until you know your position. ★

CHUTE, NO DRAG!

CAPTAIN TED R. POWERS, JR.
35 TFW
George AFB CA



"No drag chute!" But you probably already knew it. You knew it when you pulled the handle and didn't feel the sudden deceleration. What now? Aerobraking —try to get the nose back up for maximum effectiveness. Think about your airspeed and runway remaining. Think about the brakes and look for the barrier.

Let's back up a minute. It's the same old story. By the time you realize that this is a "no chute" you've passed your most effective time for action. You're playing catch up. Don't kid yourself. The landing phase of flight is the most difficult and hazardous there is outside of actual combat. To do it right is a difficult task.

There are about four things that you should have done before the "no drag chute" call. The first two occur early. Probably just prior to initial or on GCA base. Compute your final approach airspeed! Your basic FAS has to be corrected for fuel and configuration. If winds are significant you may need to add a crosswind component and gust factor. Plug those same numbers into your touchdown speed, that's going to be important. If you find yourself in the landing phase and you haven't computed those two numbers then you're starting to get behind—and fast.

The next project is to nail down an aim point based on your flare technique! That's a complicated way of saying, "know where you're going to touch down when you've slowed to touchdown speed." Then try to hit that speed about the time the tires touch the concrete. For you Weasels, the EWO is your best means of determining touchdown speed. Crosscheck your indicators on final and then have the bear tell you how you did. Then you've got something to correct from next time.

Now point four—if you've got the first three down pat you're already better prepared than most of the guys you're flying with. Have your ten degrees of pitch when you touch down! That's takeoff attitude. And, how about speed brakes? The Dash One says they're good for 4 percent off your landing roll. That adds up to 400 feet of breathing room on a ten thousand foot runway. It may make the difference.

Easy? No way. It's damn tough and we prove it much too often. With computed no-chute landing rolls that are a thousand feet short of the available runway, we're still welding brakes and watching blowout plugs lower the wheel rim to the pavement. And those landing rolls are based on "moderate braking."

Why? We land hot and long. We don't really know what maximum aerodynamic braking is. And we don't plan our sequence after we hear "no drag chute." We lower the nose and jump on the brakes.

When you land hold the nose up. Slowly start it down at 140 knots (F) or 130 knots (D), planning on 110-120 knots for touchdown. Trim full aft, and hold the stick back in your lap. Know at what airspeed you can get on the brakes and not have hot brakes after landing. It's straight out of section five of the Dash One. And if you're not going to be able to hack it, swallow your pride and put the arresting hook down, about 1000 feet prior to the barrier. It may inconvenience someone, but it's better than the price of a pair of welded brakes and two new tires. Ask the crew chief how that adds up in the inconvenience category.

Next time you fly, think about it—and prepare. Ask yourself when you're coming down final, Are you ready??? ★

the SOF



CAPT ANTHONY McGARVEY
97th Flying Training Squadron
Williams AFB, Arizona

The Supervisor of Flying (SOF) is the commander's representative in all matters concerning flying operations. He's the man responsible for the safe and efficient conduct of flying. His myriad of duties cover everything from routine scheduling of aircraft to coordinating the efforts of response teams for aircraft emergencies. Capt Anthony McGarvey describes what it's like to have the challenging and important job of Supervisor of Flying in Air Training Command.

It was 0430 on a Wednesday morning in December when I pulled through the gate at Williams Air Force Base, Arizona. The gate guard had a snappy salute for me as I drove through and he looked a lot more awake than I felt. Nine years in the Air Force has given me the opportunity to watch enough sunrises to keep a brigade of poets busy, and the thought of that golden orb rising in the east in another three hours didn't bring quite the same sense of anticipation that I had felt on my first overnight camping trip. Personally I find sunrises to be remarkably similar to sunsets, and sunsets are held at a much more civilized hour.

As I pulled into the squadron parking lot, I noticed the usual knot of early risers huddled at the door waiting for me. As the first period Supervisor of Flying, I was also the man with the key. The group would probably be composed of the usual four or five student pilots who needed to get in some last minute studying before their missions, an instructor who was raised on a farm in Iowa and thinks getting up at 0330 is normal, and two flight schedulers. As I opened up the squadron, I was grateful that nobody was in the mood for conversation. (I had guessed wrong; the cheerful farmer wasn't there.) The students hurried to their manuals and the schedulers scurried to their scheduling boards.

The flight schedulers have a rough row to hoe and put in so many hours at work that their kids have a tendency to call them "Uncle Daddy." Each of the squadron's eight flights will schedule as many as 50 flying and trainer missions a day, and the syllabus rules seem to get more complicated each year. The 97th Flying Training Squadron (T-38s) would fly 210 sorties today (weatherman permitting) and the working day would stretch out until about 0100.

The first instrument missions of the day would take off and land before sunrise. These missions would be followed by the day sorties—contact, formation, instruments, and about a dozen out-and-backs—and we would finish the daylight work by letting the last instrument takeoff log about forty minutes of night time. Then the night crew would get to work with some night formations and night solo outs on tap for today's schedule. A takeoff every three minutes with a thirty minute break thrown in here and there to let Maintenance catch their breath.

As I wandered around the Operations Center turning on switches, I scanned the scheduling board looking for problem areas. My counterpart, the SOF for the 96th Flying Training Squadron (T-37s), was probably doing about the same thing now. Our operations are pretty well independent of each other during a normal situation. There are some decisions I have to make that will affect everyone's operation and for that reason the T-38 SOF is designated the Wing SOF.

One of those decisions, which runway to use, was due now. Sgt Gerald Loehrer, one of our dispatchers, had arrived with the morning weather forecast and it looked like calm winds for the day. This meant we would be using our primary runways—30 center, left, and right. We could work off of runway 12, but student training suffered due to a lack of airspace and instrument capability. We would accept as much as a 10 knot tailwind before we would switch from 30.

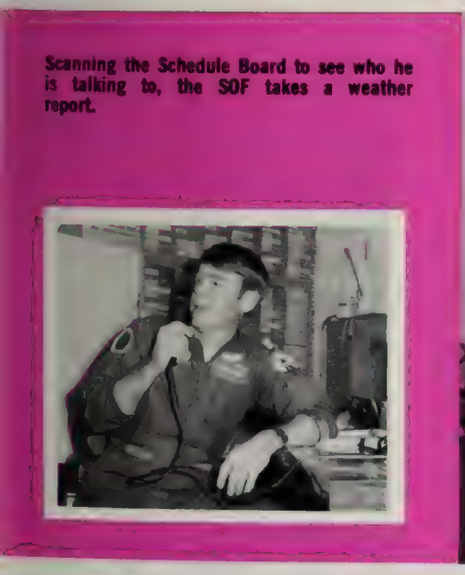
The most difficult decision this morning would be to decide which flying status to use; I have 11 to choose from, ranging from an unrestricted Alpha to a Zulu Three which means, "go away and land somewhere else." I had noticed, driving in, that yesterday's overcast had broken up and I could see stars in most of the sky overhead. Our working areas extend 100 miles to the east and I would have to rely on a weather ship to find out how the areas were. We're required to keep solos clear of the clouds and all aircraft out of icing conditions. As little as 1/4 inch of ice on the T-38 can cause engine damage and flameout.

0455 The weatherman was putting out his hourly sequence over the telewriter. He was estimating 10,000 scattered and 10 miles, which looked good but the dew point spread gave me some cause for concern. It was down to a four-degree spread which, coupled with the calm winds, meant a chance for ground fog. Sure enough, he finished his sequence with a "possibility of GF in VCNTY." I noted the forecaster's scrawled initials and came up with a mental picture of the man on the end of the electrical pencil. After two years of this duty, you get pretty familiar with each of the forecasters, and I knew this man to be one of the best. I gave him a call on the hot line and he agreed to let me know immediately if the dew point spread narrowed further.

0505 I walked outside to take another look. Distant lights looked hazy and there was a heaviness in the air. On the thirty minute drive to the base I had noticed heavy vapor rising from the numerous irrigation canals. I decided to open for a Foxtrot status.

This meant that we would have dual airplanes in the local pattern along with several aircraft shooting instrument approaches at Davis-Monthan AFB, 80 miles to the south. If any weather problems started to develop, the local pattern traffic could land immediately and the others could land at Davis-Monthan, which was forecast to remain clear.

0510 Everybody has the word on the status and the four flight schedulers for the morning shift are reworking their boards. I hoped to go at least a Bravo status (solos on the wing allowed to the areas) after the sun came up. The schedulers were lining up the day on that basis. Williams is the busiest military airfield in the



Scanning the Schedule Board to see who he is talking to, the SOF takes a weather report.



world with more than 500,000 traffic operations a year. Once the operation gets moving it can be difficult to change directions, and I need to make my decisions as far in advance as possible.

0530 My assistant for the morning has arrived and he tells me that he drove through some patches of fog on his way in from east Mesa. His job is to brief all of the aircrews on the latest weather and facility status. Pilots do not receive their aircraft tail numbers until they have talked to this man and it's our one way of ensuring that each aircrew gets the latest word. The operation is so large and the missions are so varied that our flying procedures are necessarily complicated. We have simultaneous traffice to three parallel runways, and traffic patterns and instrument approaches at four outlying facilities. If one pilot applies the wrong procedure because of bad information, it louses up the situation unmercifully. Even when the system is working smoothly, the traffic situation sometimes gets unbelievably complex. The controller at Phoenix TRACON will be issuing instructions so fast that there is barely time to acknowledge your new heading or altitude.

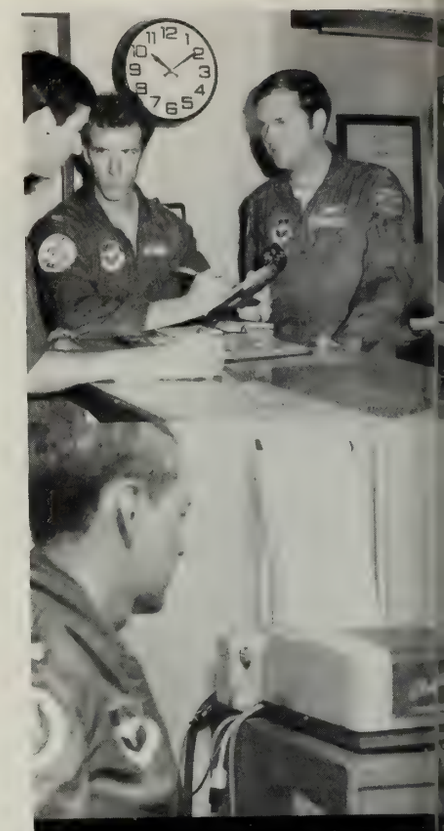
0545 I gave Phoenix TRACON a call over the hot line and they tell me that a 727 reported light rime ice over Four Peaks Intersection an hour ago. I thank him and he promises to let me know if he gets newer information. The first aircrews have been briefed and are on their way to the aircraft. The Runway Supervisory Unit (RSU) crews have picked up their equipment and are on their way to the center and outside runways. From now until it gets light enough to see what the weather is doing, the SOF desk will settl down to routin business.

0630 One of the instrument missions breaks into our paper shuffling routine with a weather report over the UHF radio. It's still too dark to tell anything about the weather away from the field but the visibility is still good. If the fog does start to develop, it will happen after the sun starts its heating action.

0700 There is a hint of greyness in the east and I'm outside again. It's scattered to broken overhead but the departure and recovery routes to the east appear to be socked in. That destroys any hope of a Bravo call. The question now is whether there is any ice in the clouds. I look on the scheduling board and pick out an experienced IP who has been airborne for about half an hour. I pass instructions to him through the RSU controller and he departs the pattern to check out the areas.

0725 The news wasn't all bad. The cloud cover is too thick to allow solos out to the area but there is no ice. We greet the sun with a Charlie status. Dual aircraft out to the areas and dual or solo in the pattern. There are a couple of patches of ground fog north of the field but it doesn't look as if we will have any problems with it. The operation is moving into high gear and it looks as if we might make some money with the sortie line today.

0805 The crash phone and the line from the outside RSU rang simultaneously. I had about 30 seconds advance warning that something was up from the chatter over the Phoenix TRACON squawk box. AWOL 42 had lowered the gear handle for a touch and go and the left main had stayed firmly retracted. The RSU controller had directed 42 to the high pattern and was sending a



Each flight crew is briefed by the Assista prior to receiving their aircraft assignment

A close watch on the electrowriter pays dividends when the weather is changing.

Preparing the birds for an early launch sun comes up over the Superstition Mou

With approximately 400 students and inst flying the T-38, an efficient information imperative.



chase plane to look him over. The distressed aircraft had plenty of fuel so we would have time to work on the problem. The situation had been declared a precautionary. This call gives us less response than an emergency but puts all agencies on alert for possible response. I directed Base Ops to have the foam equipment sent out to the runway in case we needed it.

0810 I called Flight Test and the head of the section was on his way over with a hydraulic specialist, a Northrop tech rep and an aero repairman.

0812 The RSU called in with a report that alternate gear extension had apparently lowered the gear but the left main was still indicating unsafe. This was unusual! A bad switch could cause the gear to indicate unsafe, but it wouldn't explain why the gear had refused to come down with normal extension. I told the controller to update the situation to an emergency and to send 42 and his chase to the squadron UHF frequency.

0814 I called the Center Runway RSU and told them to close the runway and start laying down an "A" pattern of foam. As AWOL 42 checked in on channel 12, I had just finished briefing the DO and the Squadron Operations Officer on the problem. The maintenance experts had arrived and we listened to 42 describe his indications of two green and a light in the handle. The chase pilot told us that the left main gear appeared to be locked down by the overcenter device. AWOL 42 wanted to try recycling the gear but I told him not to.

0817 I called the RSU again and told them to send up another chase airplane. The controller read me the call signs of the people in his pattern and I picked out an experienced Instructor Pilot and Flight Commander to give me a second opinion.

0821 AWOL 42 is down to 1200 pounds of fuel. The new chase aircraft, Willy 73, confirms that the left gear is locked in place by the overcenter mechanism. We have been unable to come up with a malfunction that would cause the indications we've seen. I decide to trust the overcenter. Crossing mental fingers, I direct 42 to land from a straight-in approach as soon as the runway is foamed.

0825 Everyone has smoothly worked into the dual runway procedures and so far we haven't had to cancel a sortie. There is nothing to do for AWOL 42 except wait. The T-38 cannot successfully land with a main gear retracted. If that left gear folds. the aircraft will wrap itself up into a flaming ball on the runway. The Wing Commander and the DO have gone out to the runway. No one has interfered with my decisions.

0831 AWOL 42 made an uneventful landing in the foam. The gear stayed down but they had to hoist the aircraft to insert the safety pins. We should have all three runways operating again in less than 30 minutes.

0840 The outside runway is closed! An F-5 blew a tire on landing and is blocking the runway 3000 feet down. We have over thirty short-legged aircraft airborne and one runway to recover them on. We have procedures that are designed to solve the problem of mixing T-37s, T-38s, and F-5s in the same pattern but there is plenty of chance for errors when you are dealing with solo students who have less than fifty hours total flying time.

0843 I grabbed an RSU controller who was standing innocently in the hall and sent him hot-footing out to the tower. His instructions were to monitor the operation and jump in with both feet if things started to fall apart. A driver had been radio dispatched to pick up the outside runway RSU crew and take them to the inside runway. I had coordinated with the 96th SOF that he would land all of his aircraft immediately and then we would start on mine. With luck no one would end up emergency fuel.

0846 I sat back listening to the chatter on the squawk boxes, trying to stay out of the way while everybody does his job.

0853 All T-37s and one minimum fuel T-38 have landed.

0900 All aircraft are down. The chief of quality control stops to tell me that the left main gear actuator had broken where it attached to the gear on AWOL 42's airplane. He tells me that it was good that the pilot did not try to recycle the gear handle. The loose actuator could have extended causing the gear to come out of overcenter.

0906 The center runway is open and we are allowing take-offs again.

0915 The outside runway is open. The clouds on the departure and recovery tracks are beginning to scatter out.

0930 Status is Bravo. The machine is humming again. Total losses: three cancelled sorties and seven incomplete missions.

1000 My relief shows up and I leave to get ready for an 1130 takeoff.

1020 The second period SOF receives a report from the outside runway RSU that the winds have picked up and there is a steady eight knot tailwind. He sighs and reaches for the telephone. . . . ★

Why Safety?

LT COL T
Directorate



I have been directly involved (that is to say, as a primary duty) with flight safety for only the past two years. To me, a 20-year operator, the job has proven to be challenging, demanding, frustrating, fulfilling and rewarding. I've been involved in all those things safety officers are supposed to do. I've counted incidents, investigated accidents, reviewed accidents, watched trends develop and subside, demanded that maintenance shape up, been appalled at operator error, been astounded at supervisors' lack of attention, and I even conducted a safety survey (we called it an Accident Prevention Analysis), ad infinitum.

I declared myself for apple pie, Chevrolet, and Blue Four. As a matter of fact, I dedicated myself to reducing the number of pilot factor accidents, or at least changing board findings to protect the pilot. I failed there, but believe I was beaten by the facts. I also thought I could eliminate maintenance errors by setting AFLC straight. Another failure.

Supervisors, I thought, were coincidental in accidents; generally they are in transit (up or down) or you can't find them. Supervisors, I now find, may be the most important link to flight safety. So here I am, after several failures, working like the devil as a safety officer. Why, you ask? Because even with those failures, like the optimistic boy, I know there's a pony here somewhere.

Pilots, maintenance troops and supervisors still make errors, as I believe they always will, yet most have been influenced by safety and some have taken that extra consideration from safety and carried the day when it otherwise would have been lost. The funny thing about safety is that we only measure our failures. Success in safety is achieved by the absence of failure (a non-graded course—pass or fail).

We in safety are the people who declared, "For want of a nail, the

LEVINS
Safety



war was lost," and we made sure that, in the next war, horseshoe nails were plentiful. The war might be lost again, but not for the want of a nail.

Of course, we wrote all of that down and put it in a folder for all to read. Unfortunately, they called it history and filed it away. (NOTE: It is an unknown fact that historians throughout the ages have maintained one of the finest safety records.)

But I digress. The question is "Why Safety?" The answer is "To win the war." We are quite fortunate because almost all of the mistakes that can be made have been made and safety has duly recorded those mistakes. The smart folks know safety history and avoid those mistakes.

Those who don't:

- Send a pilot with two hours flying time in the last 60 days to fly on a dark and stormy night;
- Put up with poor flight discipline in daily formation flying;
- Fly by the tower to confirm an inflight fire;
- Confirm an inflight aircraft problem by continuing to troubleshoot the malfunctioning system;
- Never use a torque wrench;
- Avoid crew rest;
- Ignore emergency procedures; and
- Don't change their operations to keep in step with the times.

Here at Norton we are busy recording the history of aircraft accidents, getting it ready for microfilm. Once in awhile, when a series of accidents reflects the same error, we alert the world (ALSAFECOM) to avoid that treacherous mistake. We haven't done an in-depth study of the effect of these epistles, but they seem to last for at least a year or so. (I wonder how often we change unit commanders?)

But our real source of safety wealth lies in the formal accident report. It weighs about five pounds and fills up a vault much faster than incident reports. Everybody who has something to do with the operation gets a chance to review the circumstances of the accident. It's something they can relate to. An accident investigation brings to bear a lot of light on the concerned unit. (This is good unless you're operating with a flashlight.)

Accidents are an effective way to eliminate problems within the system, not cost-effective, but they cause people to work the problem. I know some of the findings are less than definitive:

- The part broke;
- The gold visor dimmed the pilot's view; and
- Airplanes drift with the wind.

And some of the recommendations miss the point:

- Ejection seats for helicopters;
- Make the cockpit safe from mid-air collision:
- Evaluate the need for formation flying;
- Brief all pilots;
- Brief all maintenance personnel; and
- That all aircrews be impressed with the need to recognize potentially dangerous developments and that they be instructed as to the necessity for positive and timely action or reaction.

Yet, for the most part, the findings are accurate and the recommendations address the problem. The job is done, resources saved, and the war is won. There is one little drawback—money. The lack of it sometimes prevents or delays us from making a necessary modification. In some cases, we continue to fly with an identified risk. This, of course, points to another story—risk analysis, but that comes later (some other time). Back to the question—why?

Without safety would there be an F-106 fleet in 1975? Would there be more C-141s on the ground than in the air (talk about ramp weight)? Would there be a career for T-33 pilots? Would there be a PQM 102? Would there be a Davis-Monthan AFB? And finally, without safety, who would need a RIF? ★

MISSILE TOPICS

USING "MINUTES" WISELY

A great many meetings are held at all levels of command to discuss and, hopefully, resolve missile problems. Not all of these meetings deal directly with missile safety, but almost all have safety implications. Examples which come to mind are the Maintenance Manager Review Program and the System Managers Conference, usually held annually. Naturally, the safety officer can't be expected to attend every meeting on the chance that something in his area of interest might be discussed, but he can be aware of what meetings are taking place, and he should have access to the meeting minutes. A review of the minutes can then, at least, keep him "up to speed" on problems and projects that deserve his attention. With so many diverse activities demanding the safety officer's time, this is an economical and profitable way of using a few "minutes."

COMMUNICATION

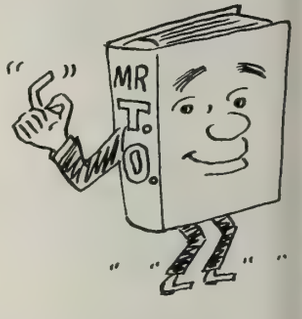
Knowing the potential accident producer and communicating with him are basic to accident prevention. But if you don't have a solid understanding of the accident picture in your field of interest, how do you go about this important aspect of accident prevention; how would you identify the potential accident producer and what would you have to say to him? You not only have to know what is happening, you must have a clear understanding of who is causing it and why. How much do you know about the potential accident producer in your organization?



POTENTIAL PERS

FOLLOW THE BOOK—FOLLOW THE BOOK—FOLLOW THE BOOK

Improper voltage was applied to a component because a wrong cable was connected; a skirt umbilical was dropped by maintenance personnel during an accident investigation; improper connection of a guidance and control cable caused a sodium chromate leak; over torquing caused a shearpin to shear in an umbilical head assembly; a crack in a pressure line B nut went undetected by maintenance personnel and subsequently failed under pressure; and a Minuteman battery charger failed, causing the batteries to be condemned. What do these six events have in common? They represent all of the mishaps that occurred in the ground launch missile fleet during the month of November 1974. All but one resulted from "failure to follow the book."

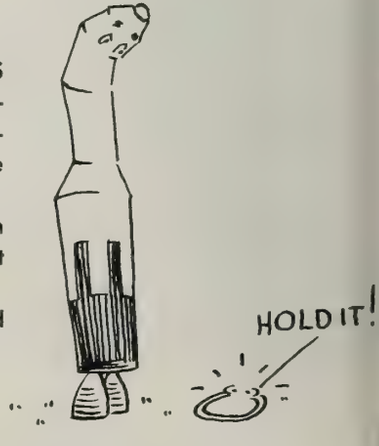


THE DISAPPEARING "O" RING

The elusive "O" ring is missing again. A review of a recent 3901st SMES evaluation shows that one technician was graded unqualified for failure to detect the absence of an "O" ring in a Titan II translation rocket release gas pressure cartridge. Also, another translation rocket was missing "O" rings on both the upper and lower gas pressure cartridges.

Two things must be remembered. First, "O" rings must be installed when technical data requires them. Second, we have had one very expensive accident which was, in part, caused by the absence of an "O" ring.

Get the word out. These little critters keep getting lost and we can't afford another accident because one is missing. ★



QUICK CHECK

the very last chance

LT COL T. R. PHILPOTT
27 TFW
Cannon AFB NM

The grave of the infamous outlaw, William Bonney, alias Billy the Kid, lies a few miles west of Cannon Air Force Base in Lincoln County, New Mexico. For many, the meeting of Billy the Kid was their "Last Chance." Today, some four score and ten years later, another last chance is faced by men of the 27th Tactical Fighter Wing flying the F-111D.

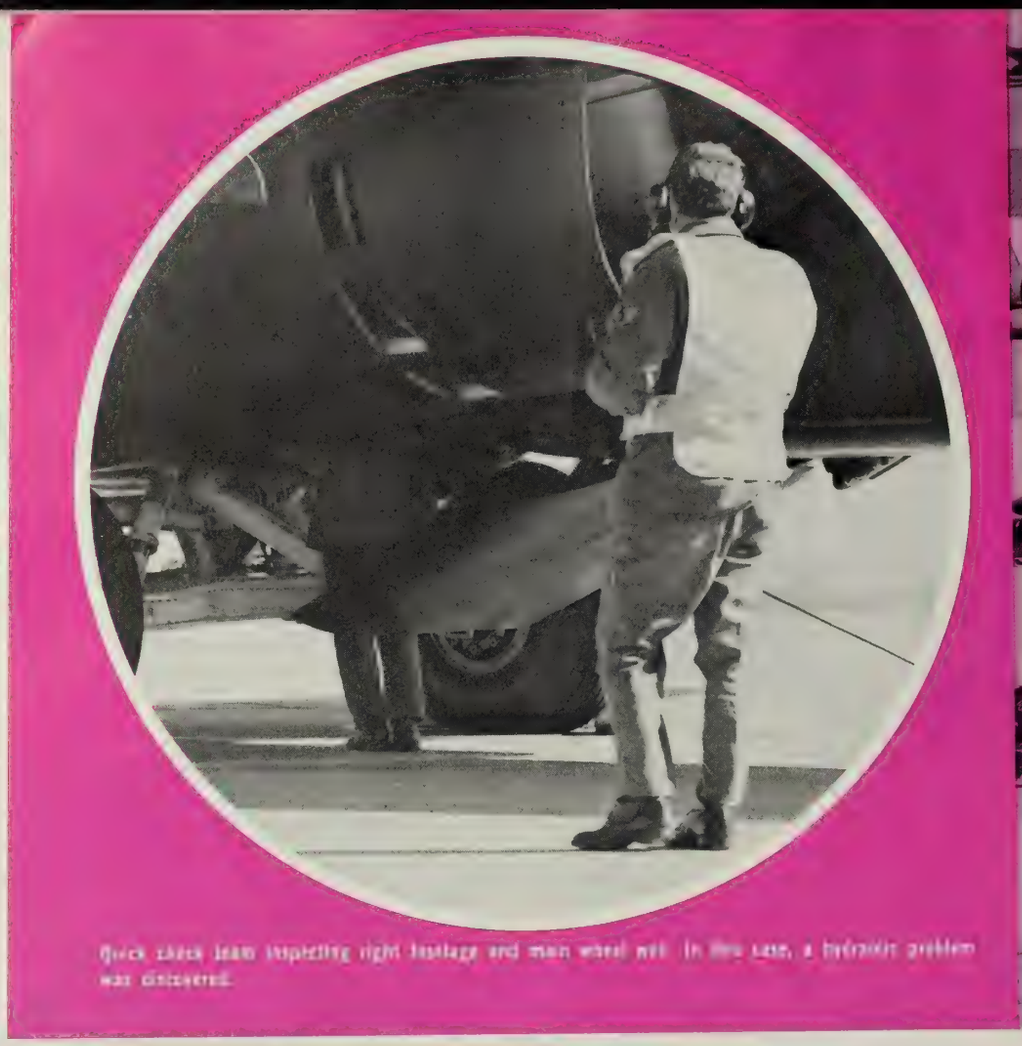
The "Last Chance" referred to, of course, is the Air Force end-of-runway quick check program. The quick check, as its name implies, is the final, quick inspection of the aircraft prior to takeoff. This check is designed to identify any safety of flight or hazardous items that may have been overlooked previously or possibly developed during taxiing.

The quick check teams are handpicked, highly skilled and trained aircraft mechanics. Even a qualified man, when assigned to the team, can expect to be under the supervision of an experienced team leader for a minimum of four to six weeks.

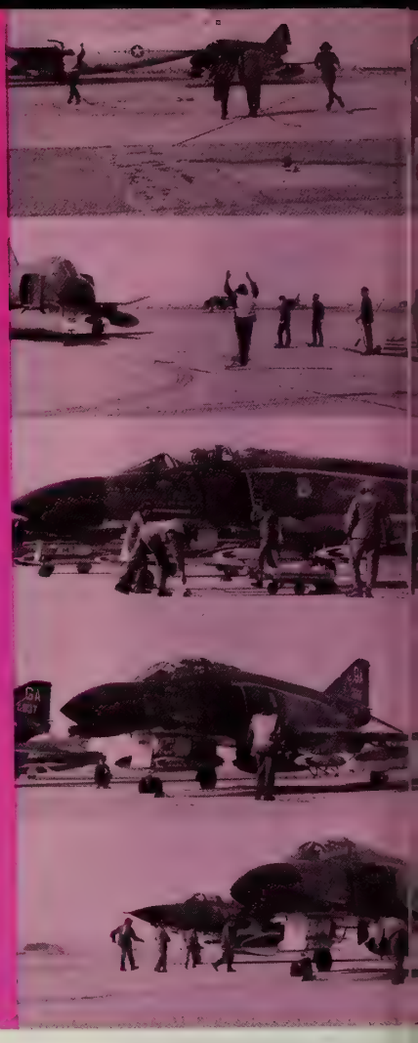
In talking with today's skilled quick check teams, it is easy to spot the grim determination and realization that a heavy responsibility rests on their shoulders. Just as the fast draw artist of frontier days engaged in a seriously deadly business, so does the modern day quick check artist. The difference is that when a fast draw man made a mistake, he paid for it, but when a quick team errs, someone else pays for it, sometimes in a final and definite way.

The duty day for the two man quick check team starts early, often before sunrise, but always at least two hours prior to the first launch. Since the flying day at Cannon may run from 16 to 20 hours a day, two shifts of quick check teams are scheduled daily; the second shift remains on duty until the last aircraft has returned.





Quick check team inspecting right fuselage and main wheel well. In this case, a hydraulic problem was discovered.



Not only is the duty day long, but working conditions are less than ideal. Like the proverbial postal carrier, neither wind, rain, snow or sleet, not to mention high winds, blowing dust and the high noise levels and jet blasts associated with Cannon's end of runway area, deter the quick check crews.

The six by eight foot quick check buildings are sparsely furnished, and even the most dedicated quick check teams admit that the time spent between launches waiting for the next aircraft to arrive is painfully boring. Aircraft in flights of two are usually scheduled every fifteen minutes starting on the hour. The teams spend approximately five minutes checking each aircraft. Quick check crews, reminiscing, admit to finding discrepancies or problems at one time or another at every point mentioned in the checklist. While all required items are thoroughly checked, quick check crews agree that even greater pains are taken when checking flight controls for proper movement, tires for any possible defects, any fuel or hydraulic leaks, and of course, any gear pins, speed brake collars, or panels which might not be properly secured.

Much of the work is routine, repetitive, and often monotonous. Yet the touch of pride in the voices of quick check crews is evident. The high motivation undoubtedly comes with the knowledge that a critically important job is being accomplished. Many items, probably the majority found on the quick check inspections, would have to be classified as minor safety of flight items. Two examples of such write-ups would be lights burned out or a panel fastener which had vibrated loose.

Fuel leaks or hydraulic leaks along with hot air leaks in the main wheel wells can spell real trouble if undetected. Major problems, such as these are occasionally spotted by the quick check crews at Cannon.

The list of one-in-a-million write-ups made by the quick check crews, not only at Cannon, but at all bases is seemingly without end: tool bag and tools found in the wheel well, gear pins still in the gear, grounding wires still connected, and foreign objects in the engine area are all items which have been found by quick check crews. Of course, as one quick check crew admitted, success can be somewhat embarassing at times. The quick check teams had to stop two VIP flights because bolts were found imbedded in the aircraft tires.



Left, Aircraft vary but the job's the same—last chance inspection before flight. Closeup at right of quick check team member, checklist in hand, checking for tire damage, hydraulic leaks.

FIGURE 1

DATE	TIME	DISCREPANCY
10 Dec 74	1915	Tail Light Burnt Out
11 Dec 74	1140	Panel Loose
12 Dec 74	1145	Hydraulic Leak
13 Dec 74	1145	Hot Air Leak in Main Wheel Well
13 Dec 74	1245	Rag Found Under Accumulator
16 Dec 74	1915	Tail Hook Panel Loose
16 Dec 74	2200	Tail Light Burnt Out

When a definite aircraft save is made, all of the long hours and efforts expended seem well worth the effort. A recent example of such a save was when the flaps on an aircraft were working a little more slowly than normal. Closer inspection revealed that the flaps were not aligned properly in the track and had cut a wiring bundle in the wing. Had the aircraft launched, it would have certainly experienced a critical inflight emergency.

Obviously, only a small percentage of write-ups by quick check crews result in the saving of an aircraft and possibly a crew. Figure 1 is an extract from a quick check crew's log which covers a five day period and is probably typical of their activities.

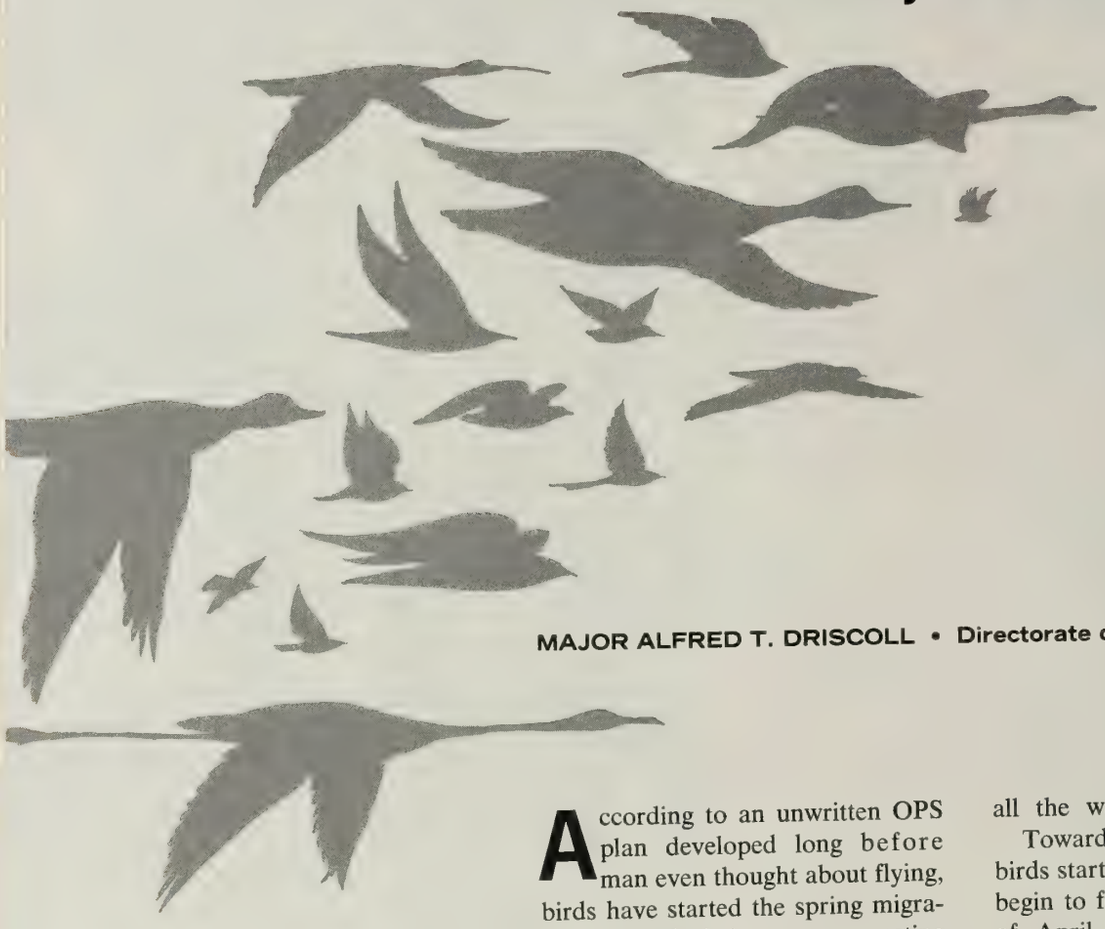
The best estimate of experienced quick check supervisors is that at least one aircraft at Cannon is saved each month from either an aborted takeoff, a serious inflight emergency, or possible loss by the quick check inspection teams' ability to spot potentially hazardous discrepancies.

There are many critics who contend that the quick check program and the resulting cost cannot be justified in this era of tight budgets and a reduced manning posture. They point out that if preflights are performed properly, aircrews and crew chiefs follow checklists carefully and mobile officers and tower operators are alert, there should be no need for a quick check. Proponents counter that if just one multi-million dollar aircraft is saved a year, the program has paid for itself. This, of course, is looking at a dollar and cent value of the aircraft versus man-hour requirements and not considering the possible saving of the most valuable asset we have—our aircrews. ★

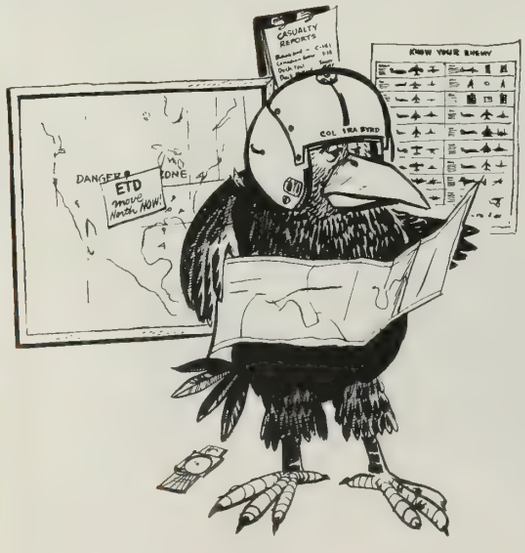


Aircrew and quick check team discuss seriousness of a hydraulic problem. Specialist was called, repairs made and the aircraft soon launched. Above photo and the one at the top left of page 18 by A1C Lewis Hale, 27 TFW Photo Lab, Cannon AFB, NM.

they're headed north again



MAJOR ALFRED T. DRISCOLL • Directorate of Aerospace Safety



According to an unwritten OPS plan developed long before man even thought about flying, birds have started the spring migration toward their summer nesting areas. Biological clocks tell them when to go, but they also check meteorological conditions such as wind direction and barometric pressure. Their routes have been passed down from generation to generation by heredity and the learning process. To stay on these routes they'll use celestial navigation and, in some cases, magnetic compass headings. Those that have learned their lessons will make it back north again.

Wintering areas range from Cape Horn, South America, to southern Canada, but the majority of birds winter in the southern USA, Mexico, Central America, and the northern part of South America. Most small songbirds migrate to Central America and South America while ducks, geese, and most hawks move south to stay in the southern United States. There are exceptions; Broadwing and Swainson hawks make it all the way to South America.

Toward the end of March the birds start to get restless. Flocks will begin to form and by the beginning of April they'll be on the move. Some will island-hop across the Caribbean and spread out after they hit Florida. Hundreds of thousands will fly nonstop across the Gulf of Mexico from the Yucatan Peninsula. Equal numbers will use the Central American bridge from South America, moving through Mexico and along the Texas coast. The ducks, geese, and swans will start north across the United States for Canada. Sandhill cranes will move out of central Texas, some of them destined for Russia. There won't be as many going north in the spring as there were coming south in the fall. Only the smart ones survived the southern trip. First year mortality rate runs as high as 70 percent for some kinds of birds.

The spring migration is a hazardous affair at best. Adverse winds and spring storms lead to exhaustion, disorientation, and death. Pre-

nature departures can cause the irds to arrive too far north before dequate spring food is available. V towers, suspension bridges, and uildings such as the vertical as- embly building at Cape Kennedy, aim the lives of thousands of birds very day during migration.

Midair collisions with manmade ving objects which we call airplanes re nearly always fatal for the birds. ecords of airplane strikes kept nce 1966 clearly reflect the acti- ty during the spring migration. An verage of 22 strikes have been re- orted in February. This increases 26 in March, 30 in April, and 32 May. By June and July, the mi- ration is over and the average has ropped to 20.

As these figures indicate, man ith his metal flying machines has n adverse effect on bird mortality tes. During the past ten years, two ctors have been working against ch other to change these statistics. far their effects appear to cancel t each other to maintain the atus quo.

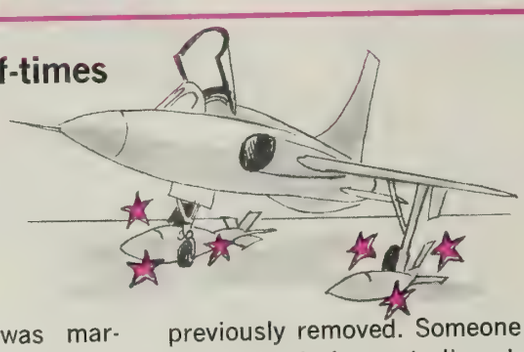
First, for the bad news—airplanes re flying much faster now. Some f them can go 10 to 15 times faster an the fastest bird. This cuts down n the time the bird has to get out f the plane's way. Everyone knows rplanes can't change direction as uickly as a bird can. Airplanes are so getting harder to see because f reduced frontal area and camou- age.

To counter this trend man has nally begun to realize that it's to is advantage to prevent the death f innocent birds and the loss of his xpensive aircraft. The USAF is anging the environment around rbases to eliminate things that at- act birds. Radar avoidance tech- ques are under study, and bird arning systems such as distress alls are being used in some cases. n the coming years, these tech- ques should reduce the hazards f the semi-annual migration and eaceful coexistence can become a eality. ★



TECH TOPICS

tanks, a-couple-of-times



A transient F-105 was marshaled to the parking area where it was refueled. As a transient alert crewmember turned off the battery switch after completion of the refueling, both external fuel drop tanks splattered on the ramp. The transient alert crewmember was wearing protective leather gloves because of cold, windy weather and as he turned off the battery switch he inadvertently pushed the adjacent inboard pylon jettison switch. Someone forgot to install the pylon safety pins.

In another case, the centerline fuel tank on an F-4E rapidly and unexpectedly traversed the short distance between rack and ramp when someone else forgot. Someone forgot to remove the impulse cartridges when the fuel tank was previously removed. Someone forgot to check the centerline station when they removed impulse carts from other stations. Someone forgot to check for carts when the aircraft went through the wash rack. Someone forgot to check for carts prior to hangar entry for phase inspections. Someone forgot to check for carts when the aircraft entered the calibration barn. Someone forgot to check for carts when the centerline fuel tank was reinstalled. And finally someone forgot to install the safety pin when the carts were found and attempts were underway to remove them.

Several people also forgot to use tech data, but what pains the most is that the pros (the supervisors) forgot to supervise. They assumed everyone else was not forgetting.

cover FOD



As the F-4 crew started the nr 1 engine, the ground crew saw sparks coming from the front of the engine. After the engine was shut down the crew found that a 2-inch by ½-inch piece of the metal intake cover mounting flange had broken off and was ingested by the engine. Now this unit inspects all intake covers to be sure the flanges are there when the cover is removed.

suitable substitute?

The F-4 needed hydraulic servicing so the crew chief pulled the servicing cart toward the PC-2 servicing point. While he was doing this, the cart handle struck and damaged the seeker head of an AIM-9E loaded on the left inboard station. The cart handle was not the original handle, which has a 30 degree bend. It was a "suitable substitute" straight handle, which at its lowest position protrudes at a 60 degree angle. This handle is not suitable for the F-4. After the incident this base found that 10 of 18 carts had the straight handles. The correct handles have been ordered.

unlocked – lost

When the A-7 pilot attempted to release a bomb from station 7, the entire MER dropped. The plyon cable assembly was not locked to the 90 degree adapter. As a result, turbulence or vibration caused the cable to come loose in flight. Then since the release system sensed only a single store, it released the entire MER.

when it still doesn't work, check it out

Investigation of a recent T-38 landing light loss in flight has uncovered the following facts: The light switches were not used during flight because the 781 had a writeup that the light was inoperative. The crew chief had installed a new light just prior to flight; however, the light would not extend when he ops checked it. The crew chief did not make a new entry in the 781 because he reasoned that the status had not changed. During the flight the light extended part way for some reason and the air loads caused it to fail. If you fix it and it still doesn't work, perhaps you should check further.

unhung jury (strut)

An F-4 suffered major engine damage when a canopy jury strut was ingested. The crew chief had removed canopy jury struts and placed them between the engine intake and fuselage. Since it was night, the crew did not see the struts during preflight. Result $26,000 damage.

tool hazard

Two maintenance men were replacing the arresting gear tip on an A-7D. As specified by TO 1A7D-2-7, one man was using a one-half inch drive hinged handle to tighten the arresting gear bolt. The gear tip was resting on a wooden block. While the maintenance man was tightening the bolt, one of the forks on the hinged handle broke. When the tool broke, the arresting gear abruptly slid off the wooden block and the observer's hand was trapped beneath it. The technician was using tech data and no extensions were being used. Apparently the tool had been cracked during manufacture and prior to chrome plating. By the way, this unit is now using a special slotted lock for arresting gear so that no one else's fingers will be fractured.

if it doesn't fit

A C-141 lost a panel from the nose wheel well on takeoff. Subsequent investigation found that the panel was a locally remanufactured part. Apparently the panel was not properly machined and shaped. This caused undue stress on the Camlocs resulting in failure and panel loss.

pressurized hoses are hazardous

The refueler inserted the refueling nozzle into the helicopter refueling receptacle. When he started the fuel flow, the fuel pressure forced the nozzle out of the receptacle. Fuel sprayed all over the refueler and the aircraft. When the flow was shut off the nozzle struck the aircraft and put a 1½-inch hole in a panel. It's a good thing it didn't hit the technician!

next time try elmer's

This is a quote from an incident report: "A screw had been twisted off in the leading edge hole of the tip cap. A new screw had been cut off and positioned in place with scotch weld."

no SOAP – no engine

On final approach the KC-135 experienced low and fluctuating oil pressure on nr 1 engine so the engine was shut down. After landing, an investigation found that several of the rings in the carbon seal were broken and the front ball holder had no bearings while the rear had 21 (each should have 12). When the investigator checked the SOAP records he found that results from a sample six days old had not been received. A phone call to the SOAP lab disclosed that the aircraft should have been grounded and the engine checked. Why wasn't it? Well, it seems that there were three men working in the SOAP lab and each thought the others had called the engine shop.

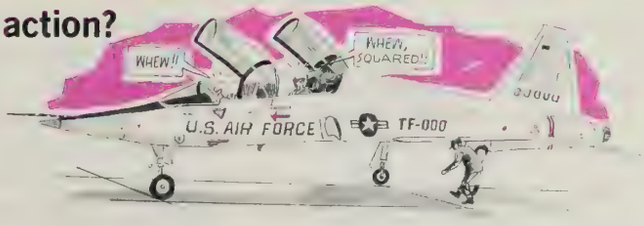
tech order deficiency



Two egress specialists were performing a canopy jettison check on an RF-4C. One man was performing the operation while the other read from the TO. Both men agreed on the line to be disconnected. However, when air pressure was applied, the thermal battery, thruster cartridge and thruster all fired. The investigation showed that TO 1F-4(R)C-2-3 does not clearly show that there are three "T" fittings in the area, only one of which should be used in this check.

Someone must have seen this discrepancy in the many years that the RF-4 has been operational. Then the question is, why wasn't an AFTO form 22 submitted? It is your responsibility to point out deficiencies in TOs or procedures when you find them.

corrective action?



The T-38 IP had made a full stop landing. Everything was fine until he tried to use the brakes. Then he discovered that he had no right brake pressure. The student pilot in the other cockpit had none either. The IP managed to stop the airplane and keep it on the runway by use of left brake and nose wheel steering. Maintenance found that air had been forced into the right brake master cylinder by the cockpit pressurization system, causing a loss of braking action. The brake system had been written up twice in the previous seven flights for brake problems. In each case the corrective action was "brakes bled."

This brake problem has been around the T-38 fleet for years. There is a fix for this problem in the TO. It's too bad it wasn't used. ★



maintenance in high places

MR. DAVID M. GILCHRIEST, San Antonio ALC TX

Working on the fuselage, wings and stabilizers of the jumbo jets such as the C-5 and 747 can be hazardous because of the heights involved. Consequently, the problems cannot be lightly considered since a fall while working these areas of the C-5, for example, would mean death or, at least, serious permanent injury.

Safe access to high work areas on large aircraft is achieved by either work stands or a high rise lift similar to equipment used by utility companies. The lifts (cherry picker —Calevar) are handy, but a rigid inspection and testing program, in addition to preventive maintenance, is required to prevent equipment failure. Also, use of a safety belt and lifeline are mandatory, and only trained and qualified operators should be permitted to operate the lift.

Work stands provide a stable work surface, permit ready access to large areas, and when properly installed, maintained and used, are safe. A possible problem is the existence of gaps and tripping hazards between adjoining stands and aircraft. Vertical and horizontal alignment of adjoining stands with each other and with the aircraft's fuselage contour creates most of these problems. Positioning marks for stands and aircraft help align the two. Care must be exercised when the aircraft is positioned, since perpendicular deviations between the centerline of the aircraft's fuselage and the positioning marks may cause significant deviations along the wing line. Before work begins, a detailed inspection of stands with the aircraft in place should be accomplished to insure that gaps and tripping hazards have been eliminated.

A problem which cannot be controlled by proper stand alignment is the use of stands designed for one aircraft or operation but used on another, for example, maintenance stands used as paint stands. When gaps or holes occur in stand surfaces for these reasons, it is usually possible to correct these potential hazards by fabricating locally designed stand extensions and covers.

To fill voids between the stands and aircraft, slotted angle material works well, and can easily be assembled and disassembled. To cover gaps in the stand work surface, an expanded metal grating which provides a suitable slip resistant surface can be used. However, exercise care to prevent an additional tripping hazard on the work surface. Gaps or holes that can't be eliminated must be effectively guarded and any safety rail design should comply with applicable provisions of AFR 127-101. For edges which cannot have permanent guardrails installed, either a chain guard or a fixed folding rail can be installed. Also, any platform edge should be equipped with a toe board.

When stands are used in harsh environments such as outdoors or in painting and stripping operations, periodic preventive maintenance is very important. This is especially true when sliding trays are used on the stands. In many cases, tray surfaces will rust or become clogged with paint residue, which causes gaps. Then either production must cease until the gap is guarded or eliminated, or people must work around the gap. Hence the importance of preventive maintenance in providing a safe work environment while not hindering production. In some cases, maintenance and repair cannot be performed while production is in progress. For example, welding cannot be performed when an aircraft is in the paint hangar.

Many C-5 work stands have been provided with an anti-skid finish, which is acceptable for routine indoor operations, but may not be for outdoor use in winter or in paint hangars. When these stands are used in these conditions additional protective measures must be used.



Maintenance in high places need not be hazardous if proper equipment, properly maintained, is properly used. Photos show the situation and some of the equipment such as safety harness, slip-resistant shoes, correctly placed workstand that permit safe working conditions. The pretty girl is Debra Baker who also appears on the back cover. She is the daughter of Col Alfred C. Baker, Jr., Deputy Director of Aerospace Safety.

Painting operations have presented significant potential slip hazards. We have attempted to correct this problem by the addition of 4' x 8' sheets of expanded metal grating over the stand work surface. While the addition of this material has improved the slip resistance of the stands, several things should be considered when installing it. When the stand work surface is sloped then the grating should be installed with the long side parallel to the slope for better traction. All grating should be installed over reinforcing rods. When the edge of a sheet comes to a work stand edge, then the edge of the sheet should be rolled over a reinforcing rod and tack welded to the stand and rod. This will help eliminate tripping hazards, should the tack weld fail.

In many cases, the risk of injury cannot be reduced without the use of personal protective equipment; in others, such equipment provides a greater degree of safety. For example, people wear slip-resistant shoes while working on slip-resistant surfaces in the paint hangar. They must also use these shoes as the only means of protection against slips when stripping the aircraft surface.

Safety harnesses should be used by persons working above the first level of work stands; and they should be used on any level when gaps or edges are not suitably protected. Working on the wings, fuselage or horizontal stabilizer requires the use of safety harnesses, and slip-resistant shoes.

Safety harness attach points must both support a load and permit free movement in the work area. In fixed hangar locations, steel cables attached to the hangar and running parallel to the centerline of the fuselage and wings meet these requirements. For areas in which long cables cannot be used, drop or pendant cables are attached to the hangar. For underwing and other such areas where no suitable cable arrangement can be installed, the use of stanchions mounted on the work stand surfaces are acceptable. When using wire rope for lifeline attachments, all cables should be periodically inspected using the same criteria as used for wire rope inspection on lifting devices. Cables should never be overloaded; the maximum number of personnel to be connected to the cable simultaneously should be posted.

The use of safety harnesses while working aircraft on the flightline is especially important since work stands are not normally used and any fall could be fatal because of the height. Fortunately the C-5 aircraft has been provided with connections which permit the ready attachment of stanchions to the aircraft wings, fuselage and horizontal stabilizer surfaces. For aircraft not equipped with similar connections, some method of attaching lifelines must be used. When this situation is encountered, work should not be performed during rain, sleet, ice or high winds. Lifelines must be adjusted to the minimum length necessary to permit the work to be accomplished.

In summary, work around large aircraft can be safely accomplished, provided that the following safety precautions are followed:

- Inspect all maintenance stands prior to use.
- Provide maintenance stand-down time when scheduling work.
- Inspect all stands and operations each day.
- Provide adequate safety training and retraining of personnel maintaining large aircraft.
- Require the use of safety harnesses and slip-resistant shoes.
- Provide work stands/work surfaces suitable for the job to be performed and the environment. ★





Courtesy of Rotorbreeze, Bell Helicopter Company

COMMON FORMS OF BEARING DAMAGE

1. *General.* The most common forms of damage that occur in operation of bearings are described in 2 through 15 below. The occurrence of any forms of damage described is sufficient cause for rejecting and scrapping the bearing.

2. *Broken, Cracked, or Split Rings.* This is often due to the wrong fit of bearings on shafts having diameters larger than specified or cocking the ring while installing or removing it.

3. *Dented Shields or Seals.* Dented shields or seals are caused by improper use of drift while disassembling.

4. *Cracked or Broken Separators.* Cracked or broken separators are caused by the presence of dirt or metal chips.

5. *Broken or Cracked Balls or Rollers.* Cracked or broken balls or rollers are caused by the presence of dirt, metal chips or overloading.

6. *Flaked areas on Balls, Rollers, and Raceways.* Flaked or spalled areas on balls, rollers, or raceways are primarily caused by excessive overloads.

7. *Bearings That Have Been Overheated.* Overheated bearings are generally darkened to a brownish-blue or blue-black color. Overheating can be caused by either excessive speed, excessive loads, improper lubrication, or installation.

8. *Brinelled Raceways.* Brinelling is caused by impressing balls or rollers into the races and appears as a series of nicks or indentations under each ball or roller. It often results when the driving force travels through the rollers instead of being applied directly to the press-fitted race. Hammer blows or sudden or excessive loads may also cause brinelling. Roughness due to brinelling may be detected by slowly rotating the bearing when the inner and outer races are tightly gripped with the forefinger and thumb. False brinelling resembles true brinelling very closely in appearance but comes from entirely different causes. Bearings which are subject to vibration, or which oscillate through a small arc instead of revolving, will show false brinelling. It is very difficult to eliminate this condition, but the removal of vibration or the use of a lubricant of low viscosity may prove effective.

9. *Scored or Etched Balls, Rollers, or Raceways.* Scoring or etching may occur on rollers or races and is caused by dragging the roller assembly across the surface of the races in a cocked position or with a heavy load on the bearing. Although scoring may look harmless, it will cause noisy bearing operation and will eventually lead to pitting.

10. *Pitting of Balls, Rollers, or Races.* Pitting is a form of damage which cannot always be avoided as it will eventually occur in any bearing which has operated beyond its expected life. However, there are many factors which tend to hasten pitting, such as nicking, scoring, brinelling, indenting, or the operating of bearings with excessive loads or speeds. Also, large currents passing through the bearing from electric bonding failures or emissions from lightning strikes can cause electric arcs that result in damage.

11. *Wear Bands on Critical Surfaces.* Wear bands on critical surfaces indicate excessive wear or improper rotation of the bearing.

12. *Rust or Corrosion on Critical Surfaces.* Rust and corrosion may be caused by handling the bearings with hands that are moist or perspir-



Various forms of bearing damage are shown in closeup photos. Article describes kinds of damage and how to prevent it.

ıg. The fingerprint patterns are ɔund rusted into the bearing sur-ıces under the lubricant. Rust on ıe operating surfaces of bearings ill rub off or flake during opera-ons and pitting will result, thus ausing early bearing failure.

13. *Excessive Looseness of Bear-ıg Due to Wear.* Excessive loose-ess is due to excessive wear. A ɔorn appearance of the balls, roll-rs, or raceways is nearly always ıdicative of excessive looseness due ɔ wear.

Note: Care should be exercised hen inspecting bearings for this efect, since various balls and roller earings are normally quite loose hen unmounted.

14. *Loose Bearings Having Wear ands.* Looseness of bearings hav-ıg wear bands is caused by dirt or ɔreign matter that has entered the ıbricant or excessive wear.

15. *Large or Deep Scratches or ther Appreciable Defects on the olling Surfaces.* Any large or eep scratches or other appreciable efects on the rolling surfaces could e caused by improper bearing re-ıoval, improper mounting, dirt or ıetal chips, or contaminants in the ıbricant.

FINAL INSPECTION

1. Immediately after cleaning operations, the bearings will be visually inspected to determine their serviceability.

Note: Bearings having light gray lubricant stains are acceptable, providing the surface has not been physically affected.

2. Where equipment covered in the section below on four-power floodlight magnifier is not available, inspect cleaned nonseparable bearings by holding the inner race stationary, and rotating the outer race. Listen carefully for excessive noise while the bearing is being rotated. Feel the surfaces for excessive roughness. Watch the bearing and listen for signs of grit or roughness while it coasts to a stop. Bearings suitable for reuse will coast smoothly and freely to a stop and will not emit excessive noise. Bearings that are defective will emit excessive noise while rotating. They will transmit easily felt vibrations to the hand while being held and rotated, and will not coast to a stop but will stop abruptly. If grit or roughness is noted during rotating of the bearing, reclean, dry, and recheck.

3. When inspecting a ball thrust bearing for roughness, do not spin the bearing. Place it flat face down on a clean table. Rotate the bearing slowly by exerting an even pressure and, at the same time, turning the palm and heel of the hand. Since the bearing is without lubrication, continued rotation will score the races. Defective bearings will emit excessive noise while rotating. They will transmit easily felt vibrations to the hand while being held and rotated. As in the case of nonseparable bearings, if grit or roughness is noted during rotation, reclean, dry, and recheck.

4. If a four-power floodlight magnifier is available, the final inspection will be made to determine the extent of any imperfection.

CHECK BEARING FIT-UP AFTER ASSEMBLY

This is very important. Make sure that the outer race is still perfectly free on the inner race (except for bearings with an original tight fit-up). If the press fit on the shaft were too tight or if the inner race were badly cocked, the bearing will bind, and that would mean an early failure. This is the time to discover it and remove the bearing and correct the condition.

1. The ideal bearing should still have a very slight looseness (except where a tight-fit bearing is required). Please note that it is possible to detect an extremely small looseness if you know how to check for it.

2. It is possible to detect as little as .0001-inch total radial play holding the outer race tightly between the thumb and forefinger and by rocking it back and forth. This is quite sensitive because a radial play of .0001-inch will usually give as much as .006-inch or .007-inch axial tilt at this point.

3. Check to make sure that the bearing is still clean. If there is a lock nut and washer be sure to wipe them off before putting them in place, especially the thread of the lock nut.

4. Pull the nut down as tightly as possible. The nut is practically useless unless it is exerting a continuous and permanent axial squeeze against the inner race. Be sure that when the nut is pulled down and the lock washer is bent over, that chips are not put into the bearing.

5. Also make sure that you do not strike the ball cage or the shield of the bearing. Sometimes the inside surface of the nut does not correctly bottom on the bearing. It may be tapered or conical, in which case it might foul the shield or the retainer and cause trouble.

6. Some designs specify a hole in the lock nut to be drilled after the unit is put together. This is quite dangerous and requires extreme care to avoid these chips entering the bearing. ★

MAIL CALL

The officers pictured as Well Done Award recipients in the November 1974 AEROSPACE SAFETY are not in compliance with AFM 35-10 standards, specifically mustaches which exceed regulation limits. I am required to conform to the standards, yet I see pictures in an Air Force Inspector General magazine where individuals are commended for outstanding airmanship and at the same time are in violation of grooming standards. If I have to comply with the manual, I think these gentlemen should also.

Sgt David G. Westerman
Eielson AFB

The Well Done nominations with pictures, come to us from operational units through the major commands. We should not publish photographs of individuals who violate AFM 35-10 standards and have taken action to prevent this from happening again.—Ed.

DISPOSITION OF UNSERVICEABLE AIRCRAFT TIRES

1. This article is not an item specifically related to safety. I feel the potential savings that can be realized within the Air Force by distributing the information to the many readers of your fine magazine warrants its publication.

2. Several suggestions, Zero Defects—Error Cause Identification forms and other studies have been made. They indicate that 25 to 30 percent of the tire carcasses returned to the retread facilities are obvious scrap and should have been condemned by the field activity in accordance with the instructions contained in TO 4T-1-3. With an average shipping charge of $3.19 per tire projected to the nine recap facilities, approximately $60,000 per year transportation costs could be saved.

3. Since the instructions contained in TO 4T-1-3 are adequate, if followed, to prevent this waste of transportation funds; recommend all tire inspection activities become thoroughly familiar with these instructions. If some doubt exists as to the serviceability of the tire, it should be returned. The contractor in most cases has better handling and inspection equipment than field activities. The tires damaged beyond repair should be condemned and disposed of by field activities.

R. C. CROUCH, Quality Assurance Specialist
Ogden ALC/MMQ
Hill Air Force Base, Utah 84406

1. Your remarks during the recent visit to Grand Forks AFB were appreciated and the appropriate actions are in progress.

2. I understand the policy requires the Rex Riley team to specifically avoid debriefing the Commander. However, I am the number one Safety officer in this wing. Therefore, I would like you to consider my input for an Aerospace Safety article.

3. The crew force is younger now with the average aircraft commander in the Strategic Air Command now 29 years old, down from 36 years old just five years ago. This fact is well known, along with many implications, such as the fact that the professional career pilot is vanishing and a new attitude can be detected that flying is a temporary assignment which comes prior to career-broadening activities and therefore is not to be approached with the same thoroughness as the old "career pilot" had. The one aspect that I want to point out is that crewmembers know how to "get through" a standboard check without reading the entire Dash One. The chapters which are most neglected are: Chapter One. The piece of equipment. Crewmembers do not know the aircraft systems "cold." Chapter Four. The same is true of the auxiliary systems and their operation, located in Chapter Seven.

4. Having been the President of more than one major aircraft accident investigation, I know these chapters can save lives and equipment, but they are often neglected by today's crewmember.

BURR V. MILLER, JR, Colonel, USAF
Commander

The challenge that commanders face to encourage professionalism is shared by the Director of Aerospace Safety and AEROSPACE SAFETY magazine. We beat that drum in almost every issue. Crewmembers and maintenance people must be shown that success and sometimes sheer survival comes from doing the best possible job at whatever we are doing at the time. Thank you for your interesting letter. Wish we had more inputs from Wing Commanders.—Ed. ★

☆U.S. GOVERNMENT PRINTING OFFICE 1975 789/855/

D STATES AIR FORCE

Well Done Award

Presented for

tstanding airmanship

and professional

erformance during

hazardous situation

and for a

nificant contribution

to the

ted States Air Force

Accident Prevention

Program.



Captain

THOMAS W. REYNOLDS

355 Tactical Fighter Wing
Davis-Monthan AFB AZ

On 27 March 1974, Captain Reynolds was flight lead for two A-7Ds staging out of McChord AFB on a dry close air support mission. Weather in the target area was 3500 feet overcast with light rain showers and mist obscuring visibility and restricting the flight to low angle simulated attacks. Pulling off his fourth high drag pass at 500 feet, Captain Reynolds experienced violent engine compressor stalls and airframe vibration. Immediately, Captain Reynolds zoomed and turned toward McChord. His wingman reported a 20-30 foot flame shooting from lead's tailpipe. Captain Reynolds ascertained that any power setting above 80 percent caused the stalls and jarring vibrations. With only 80 percent power available he knew there was insufficient power to maintain level flight with gear and flaps extended. Rain showers had left the 10,000 foot, downward sloping, asphalt runway at McChord wet with standing water. In addition, a rain shower lay off the approach end of the runway. With the deteriorating engine, Captain Reynolds decided against an emergency GCA and elected to make a descending base entry to a precautionary pattern. Entering the approach end rain shower, he found visibility restricted. By selecting and hand actuating the A-7D rain removal system, Captain Reynolds was able to acquire the VASI lights. The gear and flaps were lowered on short final when landing was assured. Captain Reynolds lined up perfectly with the runway. The aircraft was maneuvered to a firm touchdown 500 feet down the runway and brought to rest 7000 feet down the runway.

Investigation revealed materiel failure of the sixth stage of the high pressure compressor section resulting in catastrophic failure of the remaining aft section of the engine. Captain Reynolds' skill, judgment, and precision flying under deteriorating conditions, saved the Air Force a valuable combat aircraft. WELL DONE! ★

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MAINTENANCE IN HIGH PLACES

See page 2



Debra Baker, during visit to the mountains, touches up her makeup—hence Maintenance in High Places. Now that Debra has your attention, why not turn to page 24 for more on a very se subject?

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AEROSPACE SAFETY
APRIL 1975



AIRCRAFT ACCIDENT INVESTIGATION

- Stay Alive in '75
- The Meanest Man in Town
- Down with Engine FOD
- The Line-Up

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UNITED STATES AIR FORCE APRIL 1975

AEROSPACE SAFETY

THE MISSION - - - - - - SAFELY!

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Inspector General, USAF

MAJ GEN RANALD T. ADAMS, JR
Commander, Air Force Inspection and Safety Center

BRIG GEN RICHARD E. MERKLING
Director of Aersopace Safety

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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APRIL 1975 AFRP 127-2 VOLUME 31 NUMBER 4

Safety Chief Changes



Brigadier General Charles E. Yeager



Brigadier General Richard E. Merkling

Brigadier General Charles E. Yeager, Director of Aerospace Safety, Air Force Inspection and Safety Center since June 1973, ended a 33-year Air Force career when he retired 28 February. General Yeager is best known as the first man to fly faster than the speed of sound, which he did in the Bell X-1 on 14 October 1947.

General Yeager enlisted in the Army Air Corps in September 1941, served for several months as an enlisted man and entered pilot training, graduating as a Flight Officer in July 1942.

During World War II he shot down 13 German planes and was himself shot down on 5 March 1944. The French underground took him in and helped him escape to Spain from where he returned to England and eventually to combat flying.

After the war General Yeager was assigned to experimental flight test work at Wright Field, Ohio, and was selected to fly the X-1 in an assault on the speed of sound. For nine years he was the Air Force's leading test pilot, flying a variety of exotic aircraft that led to development of the nation's first Mach 1 operational fighter aircraft. After several other assignments, he returned to Edwards AFB as Commandant of the Aerospace Research Pilot School. In 1966 he assumed command of the 405 Fighter Wing at Clark Air Base, Philippines, and flew 127 missions over South Vietnam. After that he commanded the 4th Tactical Fighter Wing, was Vice Commander, 17th Air Force in Germany and, immediately prior to becoming Director of Safety, served as United States Defense Representative to Pakistan.

Replacing General Yeager as USAF Director of Aerospace Safety is Brigadier General Richard E. Merkling, whose previous assignment was Deputy Chief of Staff, Operations, Fourth Allied Tactical Air Force, a NATO command located at Ramstein Air Base, Germany.

General Merkling graduated from UCLA in June 1950, entered pilot training and flew more than 100 combat missions in Korea with the 49th Fighter Bomber Group. He served in a number of assignments and in 1966 became operations officer for the 555 Tactical Fighter Squadron at Ubon Air Base, Thailand, where he flew 100 missions over North Vietnam in the F-4. After attending the Air War College and earning a masters degree from George Washington University, he returned to Thailand as Commander of the 388TFW at Korat, Royal Thai Air Base and flew an additional 135 combat missions.

His next assignment was that of Chief Air Section, Operations Division at the Supreme Headquarters Allied Powers Europe, following which he served as Deputy Chief of Staff, Operations, Fourth Allied Tactical Air Force.

General Merkling became Director of Aerospace Safety on 1 March 1975. ★

Ground Proximity



MR. ELMER BACH
Wright-Patterson AFB OH

There is a new device on the market that is expected to save many lives and aircraft. It's called the Ground Proximity Warning System (GPWS) and its function is to provide advance warning of imminent inadvertent contact with terrain. There are various industry claims concerning the worth of the system, but generally accepted by most is the fact, that in many commercial airliner crashes in the past, the pilot would have had sufficient advance warning from the GPWS to react and avoid the crash.

Because of recent air carrier accidents in which airliners inadvertently struck the ground, the FAA issued Regulation 121.360 dated 18 December 1974. This FAR requires the GPWS on large turbine powered aircraft after 1 December 1975. The Air Force is evaluating the requirement for the GPWS as it pertains to the various Mission Design Series (MDS) aircraft that are FAA certified.

FAA Advisory Circular 25-6, dated 31 December 1974, elaborates upon required operating profiles and modes of warning for the GPWS. Any equipment manufactured for this purpose is required to provide automatic monitoring of the aircraft at any altitude below 2500 feet (radio altitude) and provide a visual-aural warning from either of four modes of operation or warning profiles. The four warning mode profiles are:

(1) *Excessive Descent Rate.* This mode provides a warning of excessive rates of descent (a predetermined profile) with respect to terrain.

(2) *Excessive Terrain Closure Rate.* This mode warns of excessive terrain closure (rising terrain) while aircraft is in level flight.

(3) *Negative Climb After Takeoff.* This mode warns of a predetermined excessive rate of sink after takeoff and before acquiring a minimum of 700 feet of terrain clearance.

(4) *Terrain Clearance Closure Rate.* This is a landing mode which provides a warning anytime the aircraft descends below 500 feet radio altitude and is not in a landing configuration, i.e., landing gear and flaps in proper position.

A fifth mode, not presently required by FAA, is being further refined and in the future may also be required. This mode is associated with the glideslope approach to the runway. A warning would occur if the aircraft were approaching the runway below the glideslope or inadvertently ducks under it.

As previously stated, the GPWS provides an advance warning of imminent inadvertent contact with terrain. Once the warning is activated, the pilot, for safe flight, must execute a positive pull up, apply engine thrust, and climb until the warning ceases. ★

Warning System

FIG 1

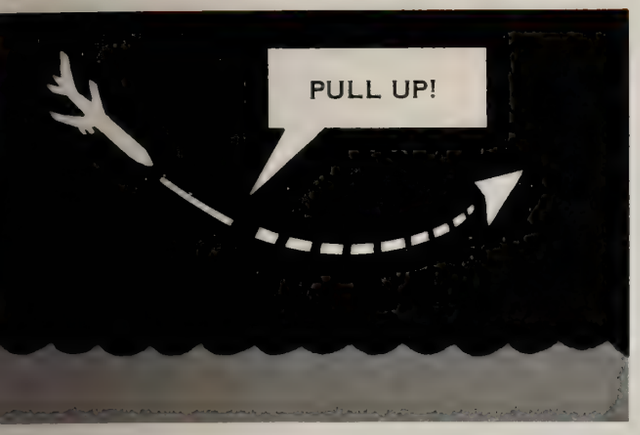


FIG 2

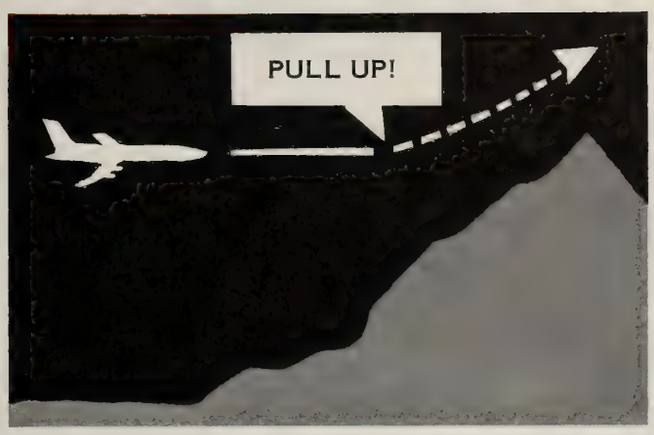


FIG 3

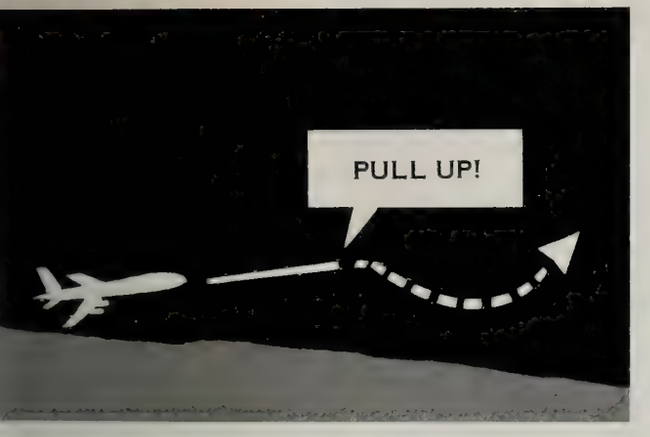


FIG 4

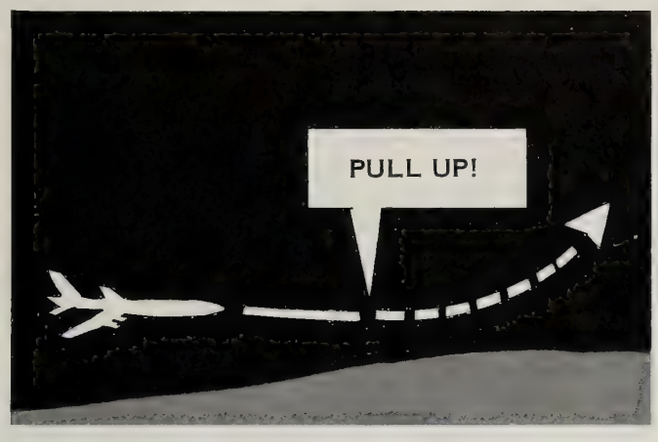
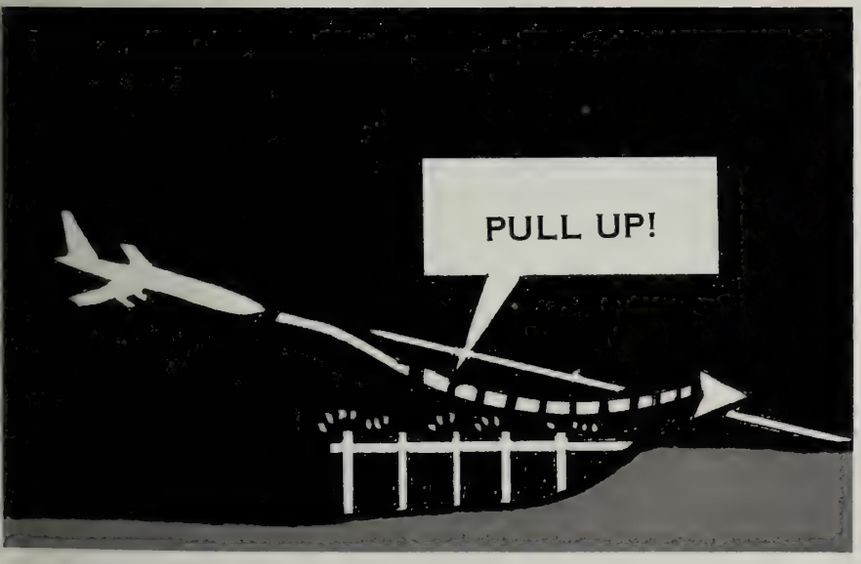


FIG 5



366TH TFW GUNFIGHTERS ASSOCIATION REUNION

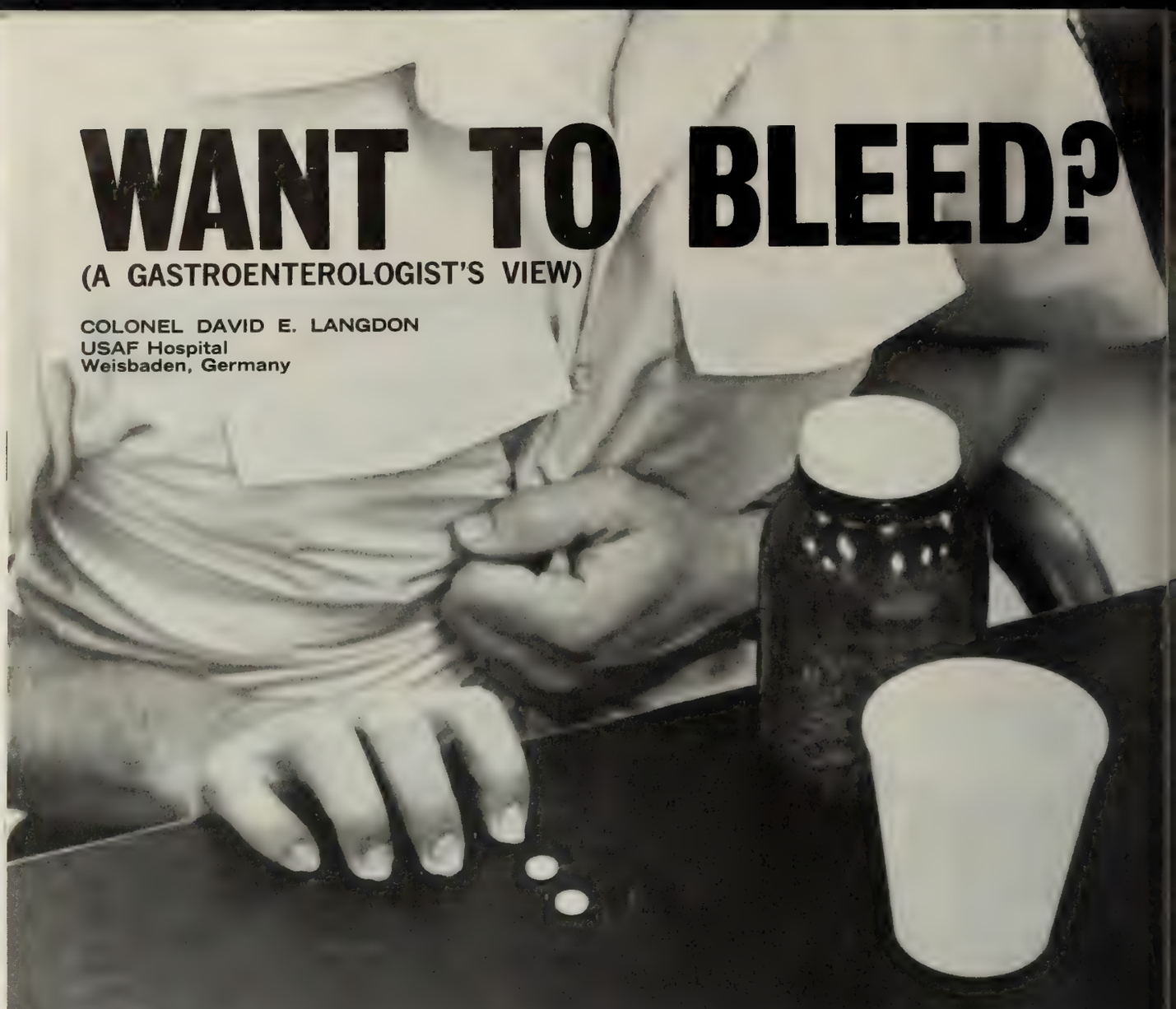
The 366th TFW Gunfighters Association will hold its annual reunion on 16-18 May at the El Tropicano Hotel, San Antonio, Texas. Contact Captain Dave Poli, Secretary, Box 4038, Mt. Home AFB, Idaho 83648, phone 1-208-832-7987 or 1-208-828-2172. All past and present members of the 366 TFW since the Wing's activation in 1943 are invited to join the Gunfighters Association and attend the reunion.

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WANT TO BLEED?

(A GASTROENTEROLOGIST'S VIEW)

COLONEL DAVID E. LANGDON
USAF Hospital
Weisbaden, Germany



Just take aspirin for stomach pains and one of these years you will! I call it "Aspirin roulette." Each month, I see one or more hemorrhaging souls because they took aspirin—buffered or unbuffered—for stomach pains. Between tubes and transfusions they blurt, "But I thought aspirin was good for all kinds of pain!"

Aspirin for stomach upsets is usually taken on a full stomach, so it sticks around for plenty of contact with the mucus. In the presence of stomach acids, it can occasionally cause little holes or "erosions," sometimes one, sometimes many. This is, [illegible] If by chance, the erosion involves a blood vessel, it can bleed. Aspirin has been found to keep platelets, little particles that help blood clot, from clumping. This can be handy in preventing arterial thromboses; but not so good, if one has bleeding erosions, the breaking blood vessels aren't plugged.

Moreover, we've seen "friendly" duodenal ulcers, those only burning or hurting a bit from time to time, converted to bleeding terrors by aspirin—even one or two tablets on occasion. For your upset stomachs, use antacids—either prescribed by a doctor, or the common, over-the-counter brands found in every drug store, BX or market. If the discomforts are more than occasional or persist for more than a day or two, then you'd better see your Flight Surgeon to reconfirm your diagnosis. If you have a headache and stomach problems, Tylenol, easily available, is a safer answer.

I have no fuss with aspirin for non-stomach conditions, though such erosions can still rarely occur. It is an excellent drug. I use it myself for non-gut pains, fevers, and so forth. I personally think that the aspirin you use should be easily dissolvable, dispersing well as you swallow it, and that is probably best taken either in a buffered form or with one of the antacids.

By following such advice, hopefully we'll never meet professionally. ★

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FOR OPERATIONS.

PILOTS NOTE

SUBJECT: APPROACH CLEARANCES.
REFERENCE: (A) EMERGENCY CHANGE TO AFM 51-37, USAFIFC/FS/DAPC MSG 121630Z DEC 74. (B) FAA NOTAM (NOTAL).
1. THERE IS PRESENTLY A MINOR DISCREPANCY BETWEEN THE EMERGENCY CHANGE TO AFM 51-37 (REF A) AND THE FAA NOTAM (REF B), BOTH OF WHICH CONCERN APPROACH CLEARANCES. THE FAA IS PRESENTLY EXPEDITING REGULATORY ACTION TO MAKE THE OPERATING PRACTICE STATED IN THEIR NOTAM MANDATORY.
2. UNTIL THE RULE IS PUBLISHED AND FINAL GUIDANCE CONCERNING APPROACH CLEARANCES IS RECEIVED ALL PILOTS SHOULD COMPLY WITH THE PROVISIONS OF THE FAA NOTAM IN LIEU OF THE GUIDANCE PROVIDED IN REFERENCE (A) ABOVE.
3. THE FAA NOTAM IS QUOTED FOR YOUR INFORMATION. QUOTE. PILOTS

PAGE 2 RUEFHQA2469 UNCLAS ALMAJCOM 0689/75
ARE REMINDED THAT WHILE OPERATING UNDER IFR ON AN UNPUBLISHED ROUTE OR WHILE BEING RADAR VECTORED, THEY MAY NOT, UPON RECEIVING A CLEARANCE FOR AN INSTRUMENT APPROACH, DESCEND BELOW THE APPLICABLE MINIMUM ALTITUDE. TO INSURE THIS, WHEN AN APPROACH CLEARANCE IS RECEIVED, PILOTS SHOULD MAINTAIN THE LAST ASSIGNED ALTITUDE UNTIL ESTABLISHED ON A SEGMENT OF A PUBLISHED ROUTE OR INSTRUMENT APPROACH PROCEDURE. THEREAFTER, PUBLISHED ALTITUDES APPLY TO DESCENT WITHIN EACH SUCCEEDING ROUTE OR APPROACH SEGMENT. IF THE PILOT IS UNCERTAIN OF HIS CLEARANCE HE SHOULD IMMEDIATELY REQUEST THE ASSISTANCE OF AIR TRAFFIC CONTROL. UNQUOTE.
4. AFM 51-37 SHOULD BE CHANGED AS FOLLOWS:
A. PAGE 15-15, FOURTH PARAGRAPH, DELETE THE THIRD AND FOURTH SENTENCES AND ADD: 'WHEN AN APPROACH CLEARANCE IS RECEIVED, MAINTAIN THE LAST ASSIGNED ALTITUDE UNTIL ESTABLISHED ON A SEGMENT OF A PUBLISHED ROUTE OR INSTRUMENT APPROACH PROCEDURE. THEREAFTER, PUBLISHED ALTITUDES APPLY TO DESCENT WITHIN EACH SUCCEEDING ROUTE OR APPROACH SEGMENT. IF UNCERTAIN OF CLEARANCE, IMMEDIATELY REQUEST THE ASSISTANCE OF AIR TRAFFIC CONTROL.'
B. PAGE 17-7, THIRD PARAGRAPH, REPLACE THE THIRD AND FOURTH SENTENCE WITH TEXT IN PARA 4A ABOVE.

PAGE 3 RUEFHQA2469 UNCLAS ALMAJCOM 0689/75
C. PAGE 17-12, SECOND PARAGRAPH, REPLACE THE THIRD AND FOURTH SENTENCES WITH TEXT IN PARA 4A ABOVE.
5. REQUEST THE CONTENTS OF PARAGRAPH FOUR OF THIS MESSAGE BE RETRANSMITTED TO ALL FLYING UNITS.
6. REPRINTED PAGES 15-15, 17-7, AND 17-12 TO AFM 51-37 WILL BE ISSUED WHEN THE FINAL GUIDANCE ON APPROACH CLEARANCES IS RECEIVED FROM THE FEDERAL AVIATION ADMINISTRATION.
BT
#2469

NNNN

FOR A MORE COMPLETE DISCUSSION OF THIS SUBJECT AND THE RESPONSIBILITY OF THE PILOT TO ENSURE A CLEARANCE ISSUED BY AIR TRAFFIC CONTROL IS SAFE, SEE "KNOW YOUR ALTITUDE", IN THE MAY ISSUE OF AEROSPACE SAFETY.

OPS TOPICS

CLARIFICATION



From January 1974 Ops Topics:
"The HH-53 was being marshalled to parking when the blade tips struck a maintenance stand. The shrapnel from the contact seriously injured the marshaller."
What the article did not make clear was that the HH-53 was clear of the stand but rotorwash freed the stand brake and the stand rolled into the rotors. The pilot did not taxi into the stand.

DEUCE ICE



The F-102 was required to hold at 5000 feet for sequencing. The pilot did not observe any ice formation. The anti-ice system was in the automatic mode. About 10 minutes later the engine compressor stalled once. The pilot requested and was cleared for an immediate approach. Since he suspected ice ingestion, the pilot did not select manual anti-ice. Because, if the automatic system had failed the manual system might release large pieces of ice into the engine. After landing, the pilot observed ice buildup of better than two inches on the intakes. The automatic anti-ice system had failed internally.

EAR BLOCK



While climbing through 4000 feet on an instrument departure the back seater experienced a pressure buildup in both ears and became disoriented. The AC leveled the aircraft until the other crew member could clear his ears and then made an uneventful recovery. The rear cockpit crew member was flying with a cold which resulted in an ear block and spatial disorientation. It is fortunate that this incident did not occur to an AC during descent, else the results could have been tragic.

CORIOLIS EFFECT

The student pilot was making an instrument departure. He looked down to change Tacan channels while the aircraft was in a 30-degree left-banked turn. While still looking inside, the student rolled wings level and continued to climb. Shortly thereafter he experienced vertigo with a sensation of spinning to the left. The vertigo lasted about 90 seconds, but the student was light-headed for about 2 to 3 minutes. The coriolis reaction had caused him to hyperventilate. Fortunately, there was an IP on board who took the aircraft and made the uneventful recovery.

RESCUE PROBLEMS



A recent accident brought to light a lack of knowledge of life support equipment on the part of the aircrew. One crew member could not locate the four-line jettison lanyards. When he attempted to make a four-line cut he lost his MC-1 knife because it wasn't attached to his G-suit. After reaching the ground, the crew could not locate the URT-33 beacon. Also, communications with the rescue helicopter were hampered because both crew members were talking on their survival radios at once.

OPS TOPICS



As the CH-3 was in the final stage of landing at the airport helipad, the downdraft from the blades picked up an aluminum boat tied down about 15 feet from the helipad and blew it 80 feet against a VW and the range weather station. The boat was cited for taking off without proper clearance.

The F-4 was returning to its parking spot after a mission. As he turned onto the parking apron in front of a shelter, the AC stopped the aircraft and indicated to the marshaller that there was insufficient clearance between the pitot tube and the front of the shelter. The marshaller indicated that clearance was adequate so the AC started to taxi. As he did, the pitot tube struck the shelter.



An F-106 ran off the runway as a result of several problems. The following is a quote from the report, "Wind 100 at 5 knots not a factor. A good headwind would have helped however."



An F-111 aborted its takeoff at approximately 90 knots for an instrument malfunction. The aircraft had hot brakes after turning off the runway. Thirteen minutes after the abort the left wheel blow out plugs activated and 3 minutes later (16 minutes from abort) the right tire also deflated.

The T-38 FCF pilot had a close call when in the course of the FCF profile he pulled the gear alternate release cable and it stuck after about one-half inch. This deactivated both the normal and alternate gear systems. After some airborne trouble-shooting, the pilot managed to reset the normal system, get the gear down and make an uneventful landing. Cause: Corrosion of the alternate gear release cable.

FLIP CHANGES

FLIP ENROUTE CYCLE CHANGE

Effective with the 24 April 1975 issue, the FLIP Enroute Charts and IFR Supplement—US and FLIP Enroute Charts and IFR Supplement, Canada and North Atlantic will be published on a 56-day cycle with a Military Aviation Notice (MAN) published, as required, between cycles.

CONSOLIDATION OF INSTRUMENT APPROACH PROCEDURES

Effective with the 24 April 1975 issue, the FLIP Low Altitude Instrument Approach Procedures (IAPs)—Canada and North Atlantic will be consolidated into a single low altitude IAP volume versus the current two, geographically split volumes. This new volume along with the High Altitude IAP volume will be published on a 56-day cycle with a Military Aviation Notice (MAN) published, as required, between cycles.

stay alive in 75

Organizations, like people, operate on a set of guidelines to remain oriented. As individuals we are governed by a complicated set of goals and time factors—hours, days, weeks, months and years. Goals are usually established against defined time periods; therefore we are, in a sense, victims of the clock.

So it is with organizations. Objectives are established, usually in terms of a specific period of time. This is a valuable thing because it provides orientation and, when realistic goals and times are set, permits the measurement of orderly progress. A danger in this approach, however, is that it may tend to produce an overemphasis on the accomplishment of short range success that could distort our long range perspective.

Nevertheless periodically we must look back to where we've been, to know whether we're going in the right direction. With this in mind, we present the following brief analysis of how we performed in accident prevention during 1974. This should help spotlight deficiencies to be overcome in the months ahead.

FLIGHT SAFETY

In 1973 the Air Force set an all time low in the number of flight accidents, destroyed aircraft and fatalities. In addition, the rate per hundred thousand hours of flying time was the lowest ever. But it's always difficult to follow a good act. Perhaps we let up a bit in 1974, because we reversed our favorable trend.

During 1974 we had fewer total accidents, but not in proportion to the reduction in flying time and sorties. The accident rate increased, and there were more major accidents, more aircraft destroyed and more fatalities. Our 1974 aircraft accidents cost 98 lives and more than $250 million dollars in equipment. With inflation and budgetary constraints, that dollar amount does not accurately reflect replacement costs and loss of combat potential.



People still cause most accidents. People who design and build the airplanes, people who maintain them and people who fly them. During the year, 20 major accidents (roughly one in every five) were directly related to engine failure. There was no significant trend since most of these failures were one of a kind. We have started action to correct the various problems. In-depth quality assurance is essential at all levels of maintenance if we are to reduce engine caused accidents in 1975.

Fire was involved in one of every ten major accidents. The causes of these fires involve a variety of aircraft deficiencies and malfunctions. Solutions to these problems have been identified, but until they are fully implemented, fire losses will continue.

One in every ten major accidents involved air combat maneuvering (ACM): two pilots flew into the water; five lost control of their aircraft and failed to recover; three caused mid-air collisions. All of these accidents, to some degree, involved disregard for established procedures. ACM is an essential facet

of our combat readiness. Strict supervision and absolute aircrew discipline are essential. We must correct deficiencies in regulations, local procedures and briefings. Flight leaders must demand absolute aircrew discipline from their flight. All crewmembers must fully understand the mission, their aircraft and their own capabilities.

Many of the accidents involved inadequate supervision. This ranged from indirect supervisory deficiencies in technical guidance or operational regulations to poor direct supervision in both the operations and maintenance areas. For example, supervisors of flying must constantly be aware of weather conditions and diversion procedures. Flightline maintenance supervisors must ensure quality inspections and complete corrective action.

From our simplest to our most complex weapon system, everyone must fully understand his equipment and his job. This includes maintenance people from the depot to the flightline and operations people from the commander to the newest crewmember. A lack of knowledge, disregard for established procedures, and/or weak supervision will inevitably lead to accidents.



During 1974 we saw the same materiel failures and personnel errors that we have seen in the past. Only the specifics change. We must minimize the risk of failure through materiel improvement and quality maintenance. We must minimize personnel errors through effective training and effective supervision. We have not yet reached an irreducible number or rate of aircraft accidents. 1975 can be better, with your help.

EXPLOSIVES SAFETY

1974 was a good year in explosives safety. The number of recorded explosives mishaps decreased significantly. We must resist the temptation to rest on our laurels because remember, 1974 was the first full year without the extensive combat activity we experienced in Southeast Asia.

There are several errors that crop up continually that you should constantly keep in mind. People still fail to put the pins in or to check to see if the pins are properly inserted in aircraft egress systems.

Here is another big killer: FAILURE TO FOLLOW TECH DATA IN THE PRESCRIBED SEQUENCE.

Some recurring MMS caused accidents resulted from inadequate pre-inspection of equipment or allowing unskilled or untrained people to perform critical operations, without proper supervision. Forklift accidents during loading and offloading usually resulted from improper operation of the folklift such as abrupt starts, sharp turns or driving over rough surfaces causing loads to shift and fall off.

Load crews frequently got into trouble when they *assumed* that ejection cartridges had been removed from a pylon prior to a circuit check when, in fact, they had not. When power was applied, the cartridges fired as advertised which resulted in a fuel tank jettisoned on the ramp.

The significant reduction in explosives accidents must then be looked at in proportion to the amount of explosives items handled and flown. It was a good year, but not as good as the first look indicated.



GROUND SAFETY

In ground safety there is some good news and some bad. First, the bad. There were 326 people killed last year in ground accidents. Now for the good news. You weren't one of them. Not very funny you say? No, accidents usually aren't—especially those that kill, injure or destroy property. There just isn't much humor in being referred to as "the dearly departed," or to be crippled or disfigured, or to know that Air Force property was damaged, when all the time these unfortunate events could have been prevented. If some one had just taken an extra moment, obeyed a sign, followed instructions, or done his job.

Seriously, all the news was not bad. Some, in fact, many accidents were prevented. A significant example is that 42 fewer people were killed as a result of 4-wheel vehicle and on-the-job mishaps.

Accident prevention has a lot to do with figuring the odds. If private motor vehicle accidents continue to decrease, the odds get better that you will not become a mere statistic. Of course YOU can do a lot to influence YOUR odds. You could drive after drinking, overextend yourself in sports and recreation, disregard tech data. Or you could work and play as if your life depended on it—IT MAY.

There were three areas last year where the odds were not good. Extra caution and vigilance are definitely needed. They were

- Industrial accidents and fires.
- Motorcycle accidents.
- Sports and recreation injuries.

There were fewer industrial accidents in 1974 than 1973, but the last three months of the year were a real disaster. The types of mishaps covered the entire range of work situations, from a fatal fall off a work stand to a fuel tank explosion. Some of the accidents are still being investigated and analyzed, but so far the best thing you can do to stack the odds in your favor is to do the job right the first time. Whether you are the worker or the supervisor, make sure tech data is followed. Keep the work area clean. A little fire can go a long way in a dirty, sloppy area.

If you're a cycle rider, you'd better be interested in stopping motorcycle accidents (it may be your accident you prevent). What can be done? You ride with your light on, wear high visibility clothing, keep yourself visible to the auto driver. Still the accidents increase faster than the cycle population. Sometimes you feel the auto driver is out to get you and that's not a completely bad attitude for you to have.

While most 4-wheeled vehicle operators don't have any trouble spotting another 4-wheeled vehicle, they just aren't conditioned to be alert for the smaller mass of the bike and rider. Of course, a Honda 175 doesn't pose the same threat as does a Mack truck smoking down on your car. When you couple the quickness of the bike with its smallness, the auto driver sincerely may not see you.

If you are a bike driver, WORK at SEEING and being SEEN and expect the worst. If you are a 4-



wheeled vehicle driver, keep reminding yourself there are more and more cycles out there. Look for them.

It's amazing how many people are dying to have a good time. People are too busy enjoying hang-gliding to take time to learn the right way. Likewise with scuba diving. In fact, water related accidents still take the largest toll of the leisure-time deaths—36 last year.

You've worked hard and earned some time off—now slow down so you can enjoy it. If we are to get the most fun from our leisure activity, we must eliminate the hurt. You've got to be properly trained and equipped. If it can be dangerous, don't go alone. Use the buddy system, and realize that you don't know it all.

Regardless of whether on-the-job or off-duty, it's largely our action (yours and mine) that's going to keep us and our friends safe and prevent property damage. You and I can use and enforce tech data on the job, be sober and alert driving our vehicle (whether it's a Honda or a Caddie), learn how to enjoy our leisure activities without endangering ourselves and others. Then maybe we can improve the odds on our being here next year (all in one piece) to compare notes.

MISSILE SAFETY

The number of ground launched missile mishaps decreased in 1974, even though the exposure remained about the same as '73. More importantly, most of the blood pressure raising types of events which seemed to dominate the scene in previous years were absent. Comparing this performance with the accident potential of the entire USAF ground launched missile establishment and our tight missile mishap criteria, we believe that the missile community has reason to be proud of themselves. Congratulations to the 99 plus percent who did the job right, by the book, every time. But the cost and dangers of the 35 mishaps that occurred suggest that more must be done.

Addressing the people side of accidents, we have studied human involvement with missiles from the training phase to the actual field conditions and vertically from the MAJCOM to the operational unit. Looking solely at Minuteman operational units, one important generality stands out. Although showing improvement, the missile maintenance team (MMT) is still a major factor in missile accidents. While by no means offered as a remedy, three observations may help to achieve further improvement. First, the repetitive nature of MMT work can lead to reliance on memory rather than the checklist; checklist discipline, of course, is a must. Second, teams on dispatch encounter frustrating delays all too frequently. With a conflicting time line, a team might be tempted to hurry up and shortcut with disastrous results. And finally, the maintenance team chief may find himself dominated by his team worker role and allow his supervisory role to take a back seat—with a greater chance of a mistake by a subordinate team member. Certainly, Minuteman operational units aren't unique when it comes to human involvement in accidents. The fact is that most of our missile and space mishaps can be traced to personnel factors. Needless to say, then, this is where we must focus our attention. ★

the line-up

MAJOR EARL L. ROBERTSON
Mt Home AFB ID

There is more to an aircraft parking plan than just a way to park airplanes. For one thing, if the bird is capable of carrying munitions then each aircraft is potentially an above-ground weapons storage area and the parking plan must take into consideration the quantity-distance criteria required by explosive directives. What is much less apparent is the effect that the way the airplanes are parked can have on flightine operations.

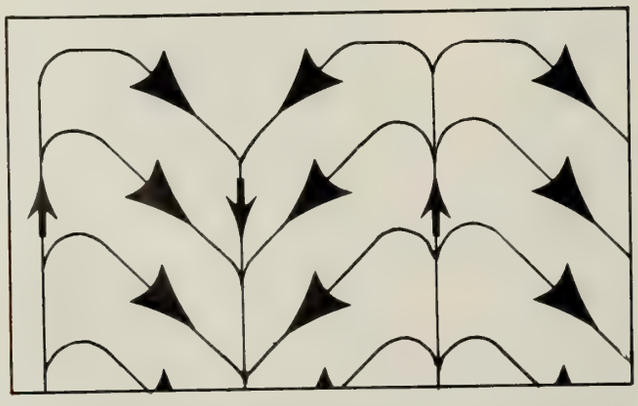
Our parking plan had been laid out with multiple short rows running perpendicular to the length of the ramp. The airplanes were parked at a 45° angle to increase the number of airplanes we could park and to decrease somewhat the effects of exhaust blast. However, the 45° parking necessitated a 135° turn when pulling into the parking spot. If the turn was not properly accomplished, power would be required in the turn. Also the F-111 side by-side seating makes taxi turns to the right difficult to judge anytime and downright hazardous on a dark ramp at night.

What made the situation even worse was the vehicle traffic. For the maintenance guys to get from one row to another they had to go "around the end" or between aircraft. The short, fast route between the airplanes was too great a temptation for the harried flight chief. Often you could see a panel truck winding its way around wing tips and stabilizers as the flight chief tried to get to a crew chief who needed assistance. The rows of airplanes were jammed together making taxiing and parking more difficult and vehicle traffic congested. Because of the close quarters an intricate traffic plan, including left-hand traffic, was required. After numerous complaints from the operators, the parking plan was changed. Soon F-111Fs were parked in two long rows stretching down the length of the ramp.

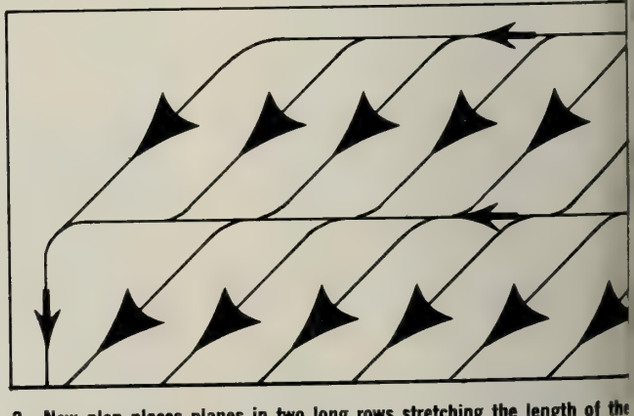
The results were outstanding. The two long rows of F-111Fs were impressive (the colonel liked that). Now aircraft traffic flowed one way in each section and the turns into and out of the parking spots were 45°.

An unexpected benefit was the improvement in command and control on the flightline. We have the same number of vehicles, but with the more open parking it isn't congested. We considered designing a flow pattern for vehicle traffic but now it isn't needed. Traffic moves normally, in a right-hand pattern. It's like driving in a grocery store parking lot when you are the only one there. Each section chief can see what his people are doing. When a crew chief needs help he walks out from behind his airplane, raises his arms and is easily seen. Any unusual occurrence is also easily seen from the control tower.

The two rows of planes may not be the best plan for your base, but it did a lot for us. We've decided the aircraft parking plan isn't just a way to park airplanes. A well-designed parking plan will facilitate all the operations on the ramp. Command and control can be improved and the supervisors' job made easier. The SPs might even be able to spot speeders easier. Well—there's a flaw in everything. ★



1 Old parking plan had multiple short rows of planes parked at 45° angle, requiring 135° turn into parking spot.



2 New plan places planes in two long rows stretching the length of the ramp. Turns in and out are 45°.

Aerial view shows new parking, illustrates easy access to all aircraft, improving command and control on the flightline.



From tower any unusual occurrence can be seen, as can a crew chief who raises hands to signal he needs help. Vehicle movement is facilitated.



THE IFC APPROACH

By the USAF INSTRUMENT FLIGHT CENTER
Randolph AFB, Texas, 78148

APPROACH PROCEDURE DEPICTIONS

Q: AFM 51-37 states: "The localizer signal has a usable range of at least 18 miles within 10° of the course centerline unless the instrument approach procedure depicts a greater distance." How is this greater distance depicted on the approach procedure?

A: The plan view and/or profile view should clearly indicate that the localizer can be used at a specific point. If the localizer is usable beyond 18 miles, the plan view should depict and label the localizer course; the profile view should have "intercept localizer" or "transition to localizer" printed on the procedure.

Q: Is the localizer course symbol printed on the plan view of the approach procedure drawn to scale?

A: No. Usually the localizer course symbol is drawn beyond the normal 18-mile flight check distance. However, action is being taken to depict the localizer to scale.

Q: I recently flew a back course localizer approach and noticed that minimum safe/minimum sector altitudes were not depicted. Why?

A: AFM 55-9 (TERPs) does not presently require minimum sector or a minimum safe altitude on procedures that do not have a NAVAID which will provide a pilot position orientation, e.g., localizer without NDB.

Q: Is the holding pattern entry diagram depicted on high altitude approach procedures directive upon pilots?

A: Not specifically. They are provided for pilots' convenience. The depictions conform to the entry procedures contained in AFM 51-37. Incidentally, the headings that depict the TD entry sector are drawn 40° on each side of the 30° teardrop course, but AFM 51-37 only requires the pilot to be conveniently aligned. The IPIS instructs 45° either side of the teardrop course as a technique because of the ease of reference on the navigation instruments.

Q: Are the feeder routes depicted on an approach procedure required to be drawn to the IAF?

A: AFM 55-9 authorizes feeder routes to be drawn to the IAF when an operational advantage exists. The feeder routes should coincide with the local traffic flow. Airspace and traffic flow restrictions may require a feeder route to be drawn to a holding fix or transition fix prior to an IAF.

LOST COMMUNICATIONS

The FAA Airman's Information Manual has some good information on lost communications: "It is virtually impossible to provide regulations and procedures applicable to all possible situations associated with two-way radio communications failure. During two-way radio communications failure when confronted by a situation not covered in the regulation, pilots are expected to exercise good judgment in whatever action they elect to take."

Lost communications/procedures are difficult to write and difficult to understand. Why? Because lost communications situations vary considerably. Did you lose your radio during departure? En route? Are you on final? Are you holding? The FAA Controller's Handbook (FAAH 7110.9D) states: "When an IFR aircraft experiences two-way radio communications failure, air traffic control is based on anticipated pilot actions." "Anticipated pilot actions" is a broad term when we consider the diversity of procedures, pilots, and situations. Because of this, air traffic controllers may anticipate two or three possible pilot actions and clear the airspace accordingly. The pilot of a lost communications aircraft in a radar environment should not have to worry about other IFR traffic (unless there are two IFR lost comm aircraft in the same area). The pilot of a lost communications aircraft in VFR conditions is still responsible to "see and avoid."

Specifically, a lost communications aircraft in a radar environment, in IFR, conditions, has one major problem—obstacle clearance. This problem becomes very serious in mountainous areas and during penetration and approach. Today's navigation equipment and chart accuracy make obstacle clearance a matter of knowing

the definitions and applications of four very important minimum altitudes:

1. Minimum Enroute Altitude. Meets obstacle clearance requirements and assures navigational signal coverage in the United States and Canada.

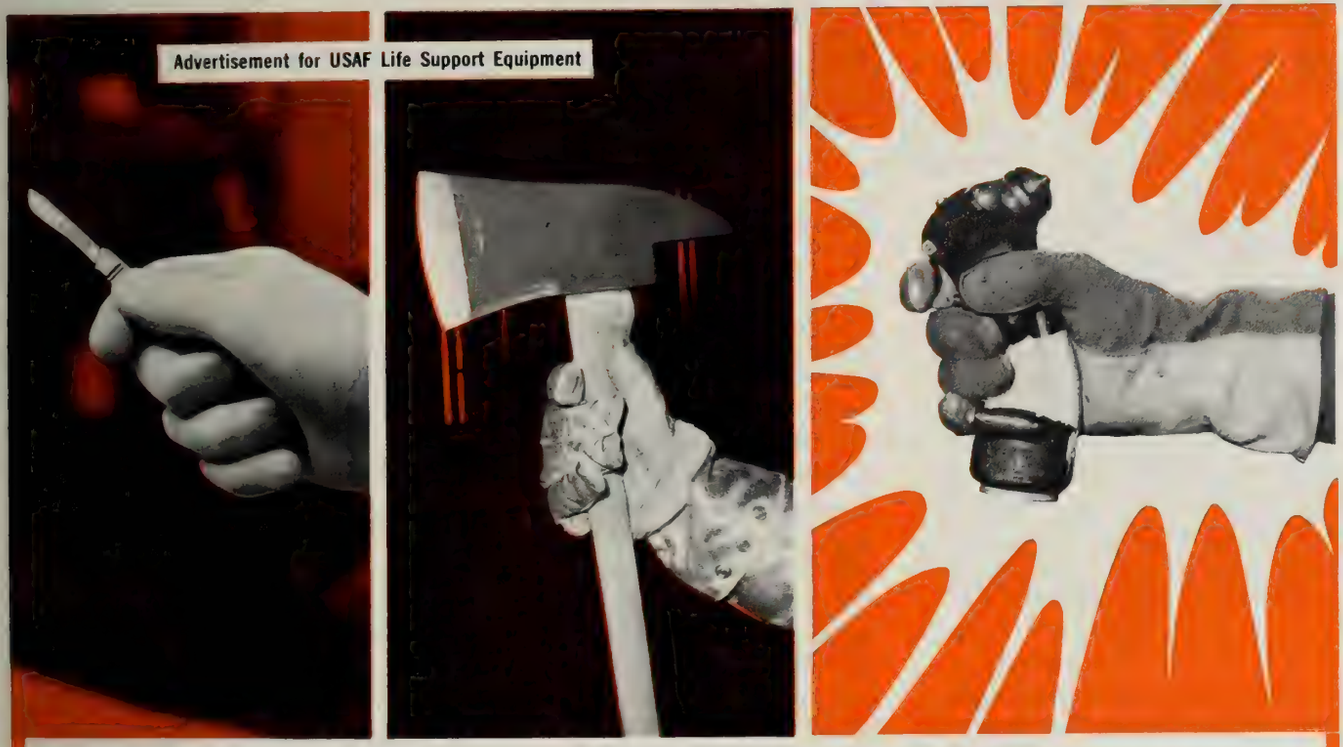
2. Minimum Obstruction Clearance Altitude. Assures obstacle clearance for the entire route and assures navigational signal coverage within 22 NM of a VOR (VORTAC).

3. Minimum Safe/Minimum Sector Altitude. Established for all procedures (except localizers without NDB) within a 25-mile radius of the navigation facility. Provides at least 1000 feet of obstacle clearance for emergency use.

4. Emergency Safe Altitude. Provides 1000 feet (2000 feet in mountainous terrain) of obstacle clearance within 100 miles of the navigational aid on which the instrument approach is predicated. NOTE: Some approach procedures may not be centered in order to make the depiction clear.

If you find yourself in a lost communications situation, know where you are, know your minimum altitudes, and apply the lost communications procedures as the situation allows.

Do you have questions or suggestions about instrument flying? Let us know. USAF Instrument Flight Center, AUTOVON 487-4276 (Directives), or AUTOVON 487-4274 (Procedures). ★



For the feather sensitive touch required in precision instrument flying and protection against fire up to 800°F, the delicate qualities of a surgeon's gloves and the bulky asbestos gloves of a firefighter are combined to bring you



HAND WASHING INSTRUCTIONS
Wash gloves as if washing hands
Rinse and squeeze but don't wring or twist
Roll gloves separately in a towel
MACHINE LAUNDERING RESTRICTIONS
No bleach
Water temp 140°F
Drying temp 180°F

FLYING GLOVES
WITH ACTION GRIP

Nomex gloves permit sufficient dexterity for manipulation of cockpit switches and harness buckles

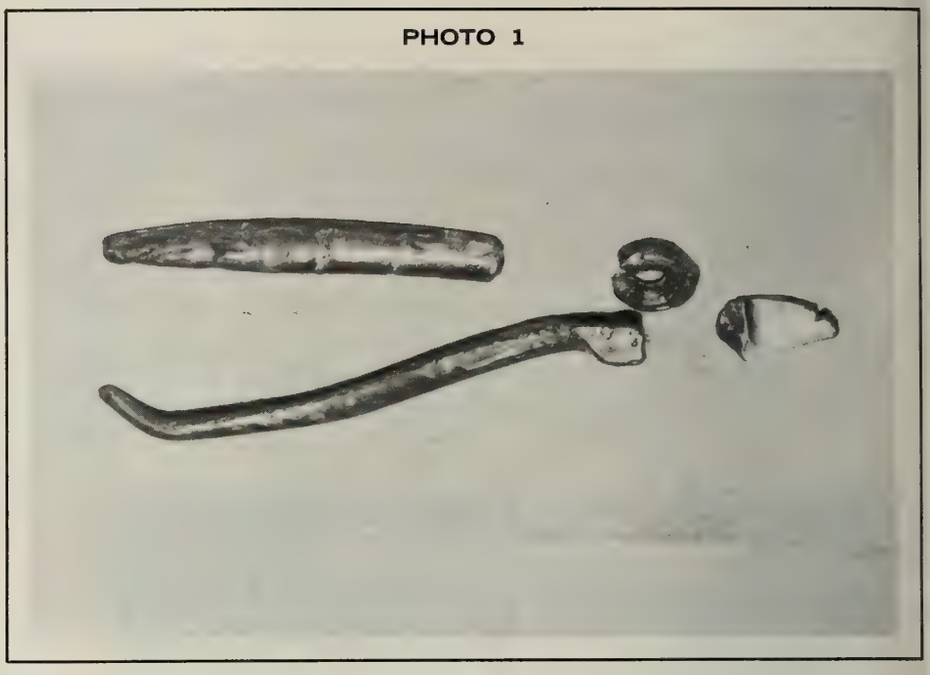
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DOWN WITH ENGINE FOD

PHOTO 1



COLONEL DONALD E. BEITSCH
Tinker AFB, Oklahoma

Foreign object damage is the most common and expensive damage in the life cycle of all type turbo-jet and turbo-fan engines. FOD discovered during depot maintenance, as well as prevention during overhaul, is an encompassing program from initial receipt of an engine through every step to final preparation prior to shipment. At Oklahoma City ALC each individual step or process has a distinct bearing on the overall FOD detection and prevention program.

Most of the FOD noted on incoming engines is in the low speed compressor and decreases progressively through the airstream area to the turbine. This damage is primarily caused by small unidentified objects entering the airstream during engine operation. Damage can seldom be pinpointed to a specific item, nut or bolt. The extent of damage indicates the rpm at time of impact. Imprints have been found on blades indicating a rivet, washer, nut or bolt caused the damage. Foreign objects entering jet engines can come from debris in runup areas and on runways and consists primarily of small rocks, gravel, and small metallic shavings. The velocity of the airflow during ground operation of a jet engine is approximately 80 mph. Turbulent air and vortexes that act like miniature tornadoes can lift loose objects which then are ingested into the engine. The effect is called "sand blasting" and, depending upon severity, may require one blade or a whole compressor to be scrapped.

The cost of a set of first stage compressor blades in a J57 (C Series) is $331.56. The cost of a case assembly fan inlet for a TF30 is $17,134.00 and the replacement cost of just one TF30 first stage compressor blade is $916.72. Obviously we cannot afford any FOD. It is like preaching to the choir, but FOD can be prevented and it is still of utmost importance to ensure that jet engines are operated only in authorized areas and that those areas are policed regularly. Where possible, the area should be hosed down to remove loose debris.

Foreign objects found in engines during overhaul come in all categories, shapes and sizes. A flashlight, or what was left of a flashlight, was discovered in a combustion can. Parachute remnants, hats, wiping cloths, rags, ear muffs, control locks and covers have been found—name it and a jet engine has ingested it. With the close tolerances of a jet engine a mere wiping cloth can start a domino effect of a bent first stage blade that can be catastrophic, finally engulfing an entire engine.

Although only a small percentage of FOD is caused by ingestion of hand tools, the damage incurred is extensive, requiring strict adherence to a comprehensive tool inventory procedure and close out inspection that could virtually eliminate this type damage. Photo one indicates what

PHOTO 2



PHOTO 3



PHOTO 4

Above, impression on inlet guide vane matches bolt head, while lower photo shows bolt thread impressions.

remains of a pair of pliers that were left in an engine, resulting in severe FOD. When we compare the cost of a pair of pliers ($3.84) to the cost of a jet engine (TF30 P3—$789,000) and possible loss of aircraft and pilot, the extra effort put forth in enforcing foreign object damage prevention procedures is insignificant.

Not all foreign objects that enter engines cause damage. As shown in photo two, a punch lodged against the gearbox drive shaft on a J75 engine presented a potential for instant disaster. The object was found in an engine returned to Oklahoma City ALC from a using activity for routine overhaul.

Statistical data indicates that 40 percent of FOD occurs immediately after maintenance. With this in mind, the FOD programs used at Oklahoma City ALC are directed toward the entire spectrum of the overhaul process and the personnel involved.

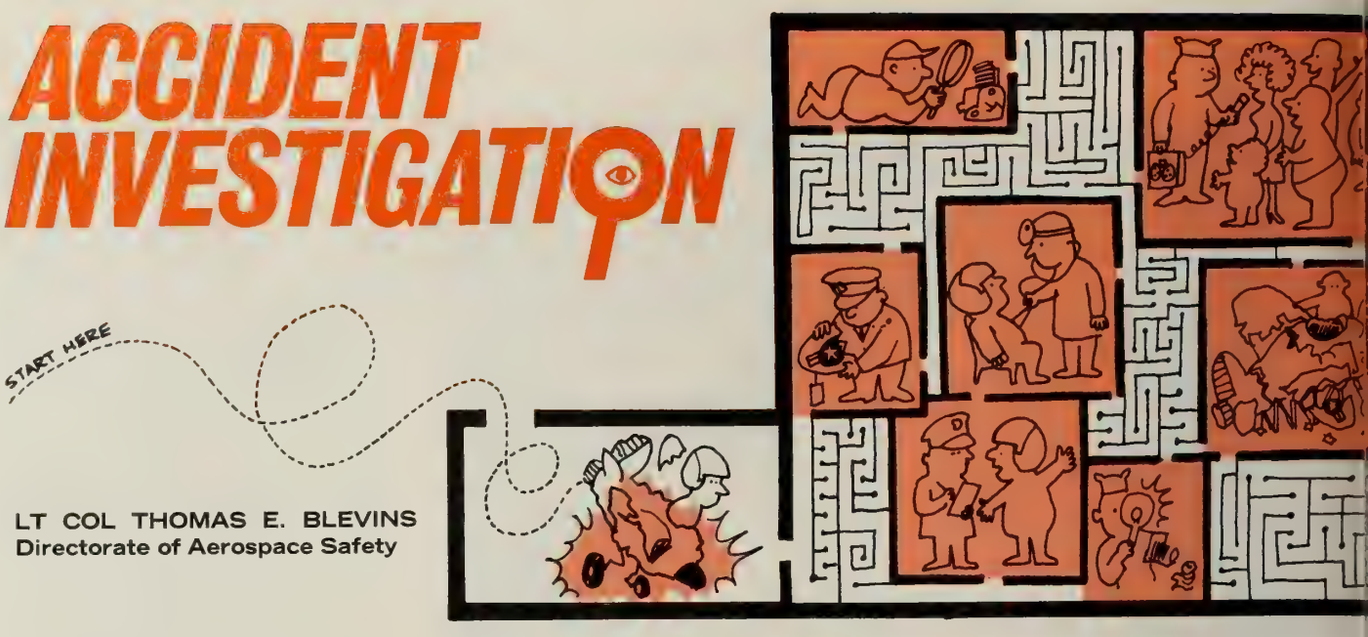
Some of the programs are as follows:

- **Tool inventory.** Tools are itemized prior to and upon completion of each job.
- **FOD education.** Posters, signs, bulletin boards and photographs continually emphasize the FOD problem.
- **Indoctrination.** FOD classes for new employees or transferred personnel.
- **FOD displays.** Components damaged by foreign objects are displayed throughout the shops. Engine preinstallation and preparation procedures are displayed at the test cells.
- **Work control document** notations and specific 100 percent inspection requirements in critical, potential and known problem areas.
- **FOD prevention surveillance.** Systematic check of each shop for adherence to established procedures and practices.

FOD is everyone's problem and it takes everyone working together to solve it. The operational activities, the supply and distribution units, the field maintenance unit and the overhaul facilities. Most of all it takes you and me. ★

LIBRARY OF THE U.S. AIR FORCE

ACCIDENT INVESTIGATION



LT COL THOMAS E. BLEVINS
Directorate of Aerospace Safety

I review accident investigations and quite often I am accused of being a Monday morning quarterback; and I always agree. That is my business. Like George Allen or Tom Landry, I look at the film after the game and decide why we lost. Like those coaches, I am not really concerned when we win. But when we lose, I am enraged. I take my time, running replays over and over, looking closely at each detail. I consume many hours deciding what the proper action should have been when the concerned player has only seconds to make the same evaluation. I do this in hope that if these circumstances occur again, each one of us will know, in that instance, what the right move is.

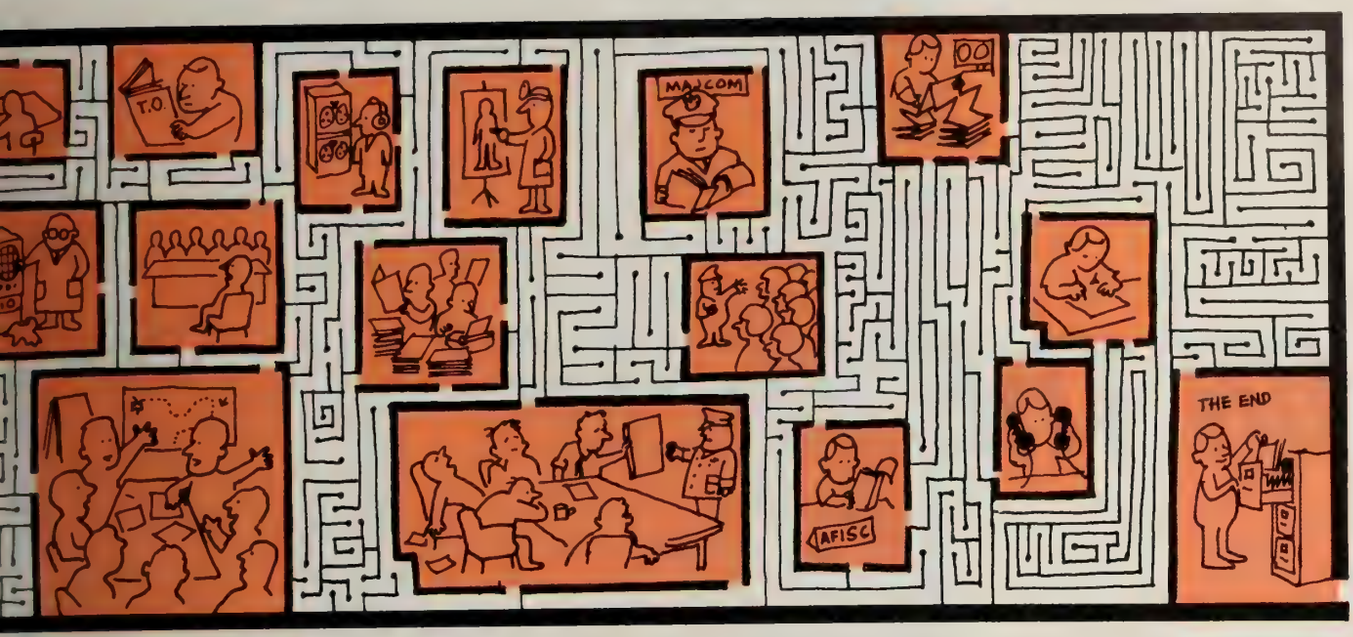
Accident investigation has progressed over the years from World War II when we just buried the wreckage, to today's formal investigation. I do not propose to outline here what the board goes through in their investigation. Many of us know what trips to wreckage are like, whether it be deep in a forest, under four feet of snow, or on the edge of a swamp where each step is two feet deep. We are aware of the problem in reconstructing the last minutes of flight. The long wait for the TDR. The flight surgeon's peculiar struggles in the smoking hole; sorting out witness statements; interviewing the participants. Discussion, many, many discussions, and arguments, many, many arguments. Then the final consideration: Supervision, Logistics, Operator? The recorder putting it all together in a five-pound folder. Most of us are aware of all these agonies. But, what happens to the report after that is not often considered. Following, then, is a notion of what happens after the board adjourns.

Formal mishap (major, minor, and incident) investigations are subjected to intensive review at all levels of command within the major command investigating the accident. If an equipment problem is identified in the report, the ALC responsible for the part and AFLC review the report. Each level gets a chance to comment, add to the findings, recommend changes to cause factors, add recommendations, or comment on the validity of the recommendations. Finally, the accident report is reviewed by the Air Force Inspection and Safety Center (AF/IGD), where all the facts and opinions related to the accident are consolidated into a single document—the letter of final evaluation.

This process of thorough and detailed analysis of accident board proceedings is a relatively recent practice. Consider that in 1958 there were 1,018 major and minor accidents. To have completed a detailed review of this number of reports would have consumed the time of almost the entire staff of the MAJCOM and certainly many elements of the Air Staff. Since a thorough review was impossible, most of the concern aroused by the accident was focused on the primary cause and the recommendations that addressed that cause. Unless the findings of the board were blatantly out of line, the findings probably stood.

Considering the fact that boards today vary in the quality of investigation they produce, some extremely accurate with detailed supporting evidence, and others who miss the cause altogether, it is certainly evident that many investigations in the past missed the accident cause. Many of these errors went uncorrected, which may have caused safety problems to continue unidentified until the next crash. Or they may have resulted in an unnecessary expenditure of money in fixing a problem that did not exist.

As the number of accidents declined in the 1960s, accident reports received more and more attention.



In 1965, the number of accidents was down to 389 and the Safety Center was reviewing each accident and closing those accidents with a letter of final evaluation consisting of two short paragraphs, concluding: "Investigation, finding, and corrective action taken are considered adequate."

In 1971 the number of accidents declined to 189, and as a result we were able to change the AF/IGD final evaluation so that it addresses the investigation in detail. The letter contains a narrative summary of the mishap, the board's findings, the MAJCOM's findings, recommendations, and action taken to satisfy those recommendations, and, sometimes, flight safety philosophy derived from that mishap.

Before this letter of final evaluation is written, a thorough review of the report is made. The board's findings are tested against the evidence produced by the investigation. TDRs are examined, command and Air Force regulations are reviewed, tech orders are consulted, and if this accident is similar to ones in the past, those investigations are reviewed. Indorsements from each level of command are considered. Minority reports are tested. Rebuttals are reviewed. The letter of final evaluation then addresses all the conflicts that arise from these documents.

As you can see, we do not take the accident report lightly. The Safety Center is quite proud of this accident investigation process and our letter of final evaluation. This letter provides the Air Force a single document that contains the essence of an accident investigation, and it is an outstanding management tool for all commanders.

There are problems in this review and closing action, the primary one being the time required to produce the closeout letter. Often this process can take as much as five months. This long span of time is caused by the requirement for several layers of command to indorse the accident report. If each reviewer takes the maximum time alloted to him, the report may stagnate. That is not to say that action to eliminate the problem cited by the investigation is held up. As soon as a critical problem is identified by the board, action begins. The main trouble with the administrative delay is that differences of opinions of commands are late in resolution and sometimes determination of proper cause factors is delayed. We are working toward faster closing action.

The letter of final evaluation is a document produced from the investigative facts and considered opinions of many levels of operation. All involved with the circumstances surrounding an accident have the opportunity to voice their opinion. This forum generally ensures that the pertinent facts are exposed and that all considerations are surfaced.

In summary, we believe that the accident evaluation process serves as an excellent accident prevention tool. The letter of final evaluation:

- Provides all interested agencies with a final summation of the information pertinent to each accident.
- Validates recommendations addressed in this accident.
- Resolves differences between MAJCOMs.
- Provides convening authorities an evaluation of how their accident boards perform.
- Provides commanders a summary of actions underway to eliminate the problems that caused the accident.
- Provides Air Staff safety philosophy derived from the accident.
- Reduces the possibility of a similar occurrence *if we heed the lessons to be learned.* ★

ON THE SHELF



MAJOR JACK K. CLAPPER
Military Aircraft Storage and Disposition Center (MASDC)
Davis-Monthan AFB AZ

MASDC (pronounced MAZZ-DECK) stands for Military Aircraft Storage and Disposition Center. It is located at Davis-Monthan Air Force Base, Tucson, Arizona. Aircraft not required in the active fleet are stored in the desert where the effects of the elements on aerospace vehicles are minimal.

Many of these stored aircraft, due to changes in the political/military/economic climate, again become mission essential. The Vietnam conflict led to several types of stored aircraft being pressed into service. The California Forestry Service bought several S2Es for airborne forest fire suppression. South and Central American governments buy C-47s and S2Es. F-100s went to Turkey and Denmark last year. Historically, more than one hundred aircraft are removed from storage and flown out of MASDC each year.

Here's what happens when an aircraft is being returned to service. The engines are depreserved, the flight control systems are serviced and the landing gear is checked. Inspections are made for corrosion damage and general deterioration. The aircraft are given a form of phase inspection, necessary repairs are made and it is declared ready for test. Qualified functional check flight crews, usually TDY from an operating organization, perform the appropriate inflight tests. Any major discrepancies are corrected. The aircraft is ferried to its destination. In other words, it's more than a storage area; it's a dynamic operation. That aircraft you sent into storage today, usually the hangar queen further debilitated by massive cannibalizations and switching of good equipment for bad, may be the same one you're going to test-fly for airworthiness in the future.

Given the requirement to place an aircraft in storage, anyone in his right mind is going to get rid of his problem aircraft and equipment. With today's austere funding, who



Aircraft of all kinds are stored in desert at Davis-Monthan AFB, Arizona. Many will fly again.

would overlook an opportunity to add to his bench stock by removing non-essential items from a storage-bound bird? What pilot is going to waste time writing up discrepancies on an aircraft that's never going to fly again, anyway?

An example: A multi-engine aircraft is being prepared for a flight to Davis-Monthan for storage at MASDC. There's a need for an AC generator on another aircraft. The storage-bound bird's AFTO 781 write-up says "Removed AC gen nr 4 engine for aircraft 122. Leads taped and tied." Oops, now somebody needs a TACAN antenna. 781 reads "TACAN antenna (AT-722) canned for A/C 051." Anybody need a clock bracket? "Navy 8-day clock bracket K-balled for acft 548." How about a voltage regulator? "Removed Rt AC voltage regulator for A/C 137." How about that huge radome under the belly? "APS-95 antenna pedestal removed because aircraft going to boneyard." "Left A/C generator removed for Acft 307." "Left VARD box removed for A/C 128." "Nr 1 D.C. over-voltage relay removed." "Removed L/H A.C. Gen duct for acft 133." "Removed R/H D.C. Gen duct for acft 133." "RH VARD box removed." "Nr 1 D.C. Gen. removed." "Nr 4 D.C. Gen. Removed." "Nr 4 F/Q calibration bridge unit removed for A/C 501." "Left aux oil qty calibration bridge unit removed for A/C 062." "8 each clocks removed from aircraft. All are defective."

The crew made it into Davis-Monthan. They dropped parts of the aircraft enroute, but they made it. What happened was, when they removed that big radome from the belly, they didn't bother to unscrew all those screws. Looks as if it was cut off with metal shears. That left jagged and loose edges of sheet metal. The edges peeled back during flight. The metal began flapping against the fuselage until a number of good size chunks apparently fell off the aircraft. Another piece fell off as the engines were undergoing a preservation run.

A check of the 781H shows the aircraft commander signed it off as an "OK" flight. Looking further in the 781A shows that a lieutenant from OMS erroneously changed a bunch of Red Xs to Red Diagonals "because aircraft is going to boneyard." (Should have been dashes and maybe more horsepower than a lieutenant.) Also shows all four engines had been pickled for storage and during the de-pickle run nr 3 engine had an internal failure and fire. It was replaced.

So, when you start to downgrade a Red X because the aircraft is "going to the boneyard," ask yourself these questions: (1) Is the aircraft really safe for flight? (2) Would you want to be responsible for accomplishing a functional checkflight of the aircraft on an "as is" basis? And when you're the pilot who ferries it in, ask yourself if you'd like to be the FCF pilot on that future flight out of storage. If not, tell us why in the 781. ★

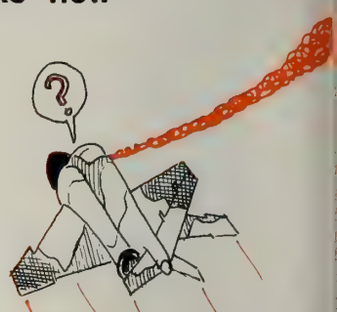
TECH TOPICS

tool FOD again



When the F-4 landed after the left engine failed, maintenance found extensive FOD to the engine. The imprints on the blades resembled those made by an apex bit and adapter. The day before, a sheet metal specialist replaced four loose rivets inside the engine inlet. But he did not complete a tool inventory when the job was finished.

sparks flew



After about 45 minutes of an F-4 flight, sparks and smoke were observed coming from the area of the right rudder pedal in the rear cockpit. The crew landed at a diversion field and investigated. Seems that the aircraft battery hold down rod and wing nut were not properly secured. The rod came loose in flight and struck the 115 volt AC terminal of the ECM circuit breaker panel.

formula for a towing accident



Investigation of a recent towing accident that cost more than $325,000 revealed the following facts.

- The tow team was incomplete. The safety monitor was also acting as tail walker.
- The tow tractor operator's records showed no record of certification for this type of operation.
- The taxiway being used was covered with ice and snow obscuring the taxi lines and boundary warnings.
- An obstruction was not marked.

Are there any such operations at your base?

winter FOD



Two technicians were performing an engine ground run on an A-37. The inlet screens were raised for the initial run but after 15 minutes they became completely covered with ice. So, the supervisor elected to continue the engine run with the screens down. One man was working on an access panel on the engine nacelle. As the supervisor (who was in the cockpit) leaned over the canopy rail to supervise the other man, his headset and hat were sucked toward the engine.

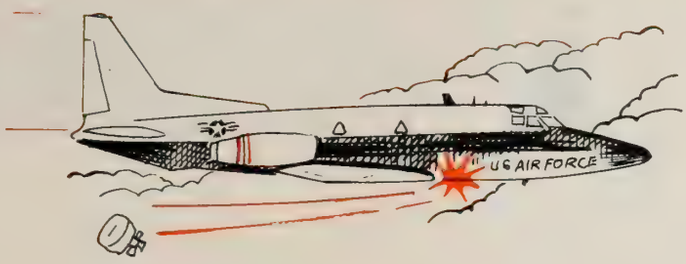
The sergeant was able to grab the headset but the hat was ingested. The hat had serviceable snaps on the chin strap but they were not secured.

don't Jack, murphy



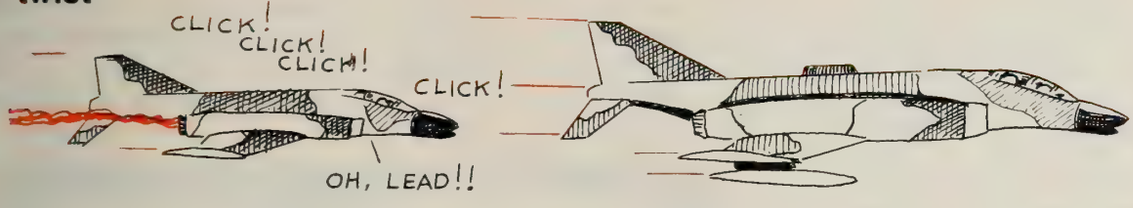
A jacking operation resulted in a major ground accident and $37,000 in damage to a KC-135. The crew that was performing the maintenance did not follow the steps or precautions prescribed by the TO. The wing jacks were not seated and the jacking supervisor allowed the jacks to be pressurized without sufficient personnel to accomplish the task properly.

lost caps



The T-39 is losing single point refueling caps. The caps are serviceable prior to flight but, because they are not being properly installed, they vibrate loose. Transient alert troops, be alert. You can prevent this kind of incident if you just tighten the refueling cap.

cable twist



As the F-4 pilot was attempting to rejoin his leader, the right engine flamed out without throttle movement. The pilot attempted four starts but was unsuccessful. The throttle cable was twisted during an engine trim the day before. As a result, the engine was not properly rigged and the fuel flow went to zero at idle throttle setting, which caused the engine to flame out.

mini FOD

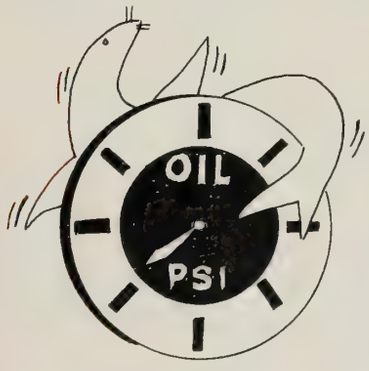


While in the traffic pattern the T-37 crew experienced abrupt full nose-up runaway trim. Despite all efforts of the crew, the trim stayed full nose-up until after landing. Then it began to work again. Investigators found a two-inch piece of very fine wire lying across two terminals which control the trim. This wire was probably one strand from a multi-strand wire but a source could not be determined.

take a sample . . . and the tube!

The KC-135 made an emergency landing after one engine was shut down for low oil pressure. The low pressure was caused by a SOAP sample tube someone had dropped into the engine. This error had less serious consequences than an earlier one. In that case an F-100 crashed, killing the pilot after the engine failed for the same reason. In neither case was the loss of the tube reported. Anyone can make a mistake but if you do, don't compound it, tell someone!

unsealed seals



In three recent incidents aircrews were forced to shut down engines for loss of oil pressure. In each case an oil seal was improperly seated, which allowed it to be crimped or cut by the cap and it leaked.

Fortunately these were multi-engine aircraft and the crews could make a safe landing. But the question still remains. What happened to tech data procedures? ★

A SHOCKING

The report said, in brief, that a man working near an aircraft received a violent electrical shock which knocked him down. There were clouds overhead, but no lightning struck the aircraft or any nearby object on the ramp.

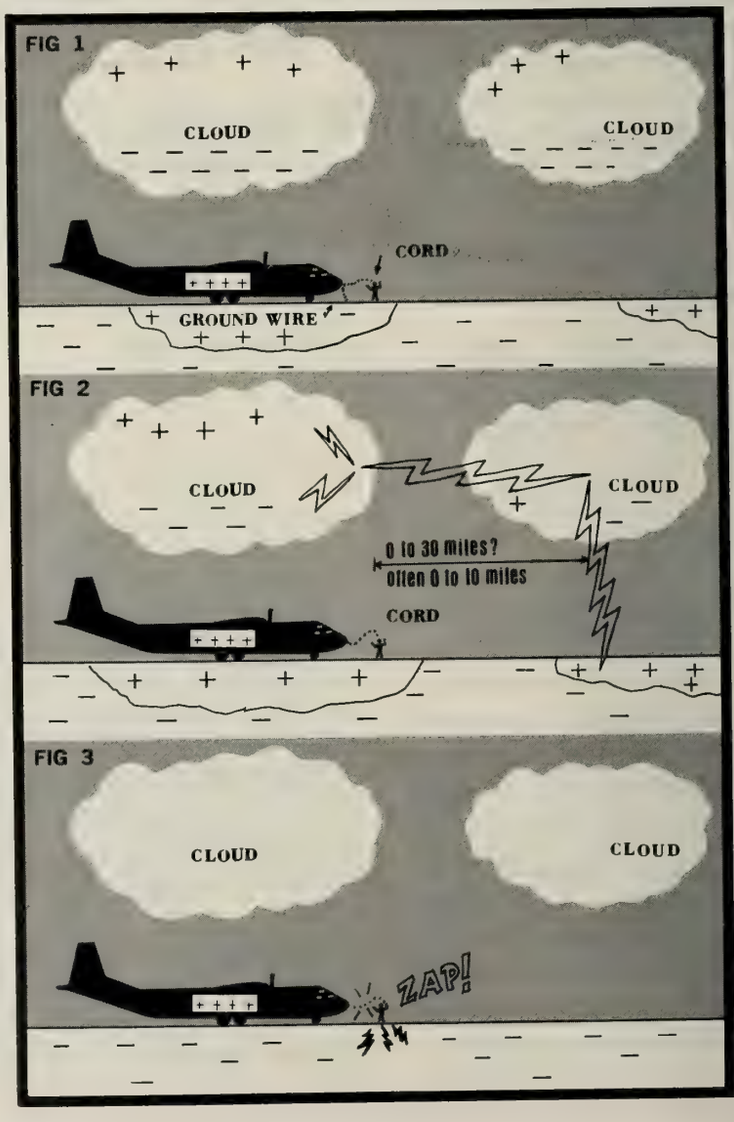
I was reminded immediately of a conversation with my friend John Robb of the Lightning and Transients Research Institute. He had described similar incidents involving airline maintenance personnel. Now it had happened on an Air Force base. Here's the story in more detail and why it happened.

Numbers 3 and 4 engines had been started when the supervisor of flying informed the aircrew of a weather advisory. The aircraft commander, unable to contact metro called ground control for the latest forecast. It was at this point that the loadmaster was seen lying on the ramp in front of engines 1 and 2, and medical assistance was requested through ground control.

It is suspected that the loadmaster's long interphone cord picked up electrical current from either the aircraft or ground and the loadmaster received an electrical shock as a result. A medical examination revealed no signs of injury.

The weather was 3000 scattered, 8000 broken, 15,000 overcast, visibility seven miles, wind 180 degrees at five knots. The altimeter was 29.90 inches of mercury. Thunderstorms and rain showers were in the vicinity. A weather advisory at the time the loadmaster was struck down indicated cloud to ground lightning in the vicinity.

Here's how the loadmaster probably got zapped without being struck by lightning. Clouds, particularly thunderstorm clouds, acquire a strong negative charge at the base. (See Figs 1, 2, and 3.) The strong negative field causes



STORY

MR. ROBERT SHANKS
Directorate of Aerospace Safety



the electrons to move away from the area of the earth immediately below the cloud. This makes the spot on the earth positive with respect to the cloud above it. An aircraft grounded to the earth will also have the same charge as the earth to which it is grounded.

Once engines 3 and 4 were started, the ground wire was removed in preparation for starting engines 1 and 2. Since the aircraft and the ground near it were at the same potential, nothing happened when the ground wire was removed. With the ground wire removed, the tires acted as a high resistance path to ground. The loadmaster still had his headset on and was connected through it to the communication network and ultimately to the aircraft structure at the electrical common ground.

It is theorized that at this time a lightning strike flashed from cloud to cloud and then to ground at some distant point and the negative charge in the cloud above the aircraft was neutralized or discharged. The mirror image of that charge on the ground would also be neutralized by electrons flowing from adjacent earth to the spot under the clouds. Since the ground wire was removed, the aircraft became isolated from the ground and acted as a large capacitor. The discharging current would take the path of least resistance, which in this case would be through the loadmaster to his headset and then down the cord to the airframe.

Fortunately, because the electrical capacitance of the aircraft was limited, the shock was not fatal. However, it could have been if the man had a weak heart or if he had injured himself when he was knocked down by the muscular spasm produced by the high voltage differential suddenly appearing between the ground and the airframe.

This is why it is dangerous to be around an ungrounded aircraft when storm clouds are overhead. It also shows why we need to have low resistant ground wires on aircraft so that sudden changes in potential will traverse the ground wire rather than arc to some maintenance man standing nearby or touching the aircraft. ★

THE MEANEST MAN IN TOWN

HAROLD POEHLMANN
Fairchild Republic Co.

The meanest man in town is not the guy who kicks dogs or hands out candy laced with hot pepper at Halloween. The title goes to the aircraft maintenance man who, during trouble-shooting, jabs meter test probes, nails or other pointed objects into electrical sockets.

There is nothing more frustrating than trouble-shooting (or attempting to verify) an electrical malfunction when some undetected electrical pin doesn't have the correct tension grip in its socket. Lack of tension will make the electrical connection intermittent during in-flight and ground circuitry testing. When the electrical circuit is used to conduct potentiometer values and the pin is not tight you will get real "squirrely" symptoms.

Unsatisfactory Materiel and Incident Reports indicate this problem is on the increase. The solution is simple: Do *not* insert a test probe or object into a socket that exceeds the dimensions of the corresponding pin.

I recollect one plug on an F-84F that had eight pins inserted at various positions. When the crew chief





FIGURE 1



FIGURE 2

FIGURE 3

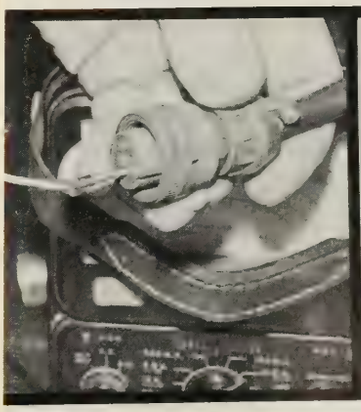


FIGURE 4

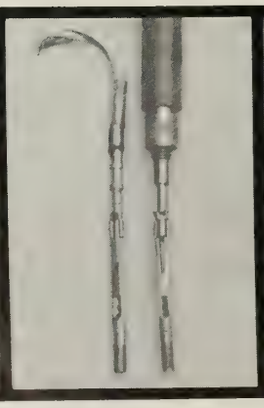


FIGURE 5



FIGURE 6

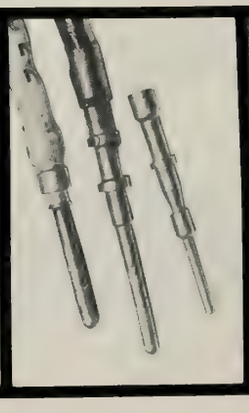


FIGURE 7



(in those days the crew chief was electrician, sheetmetal, hydraulic, and engine man) tilted the plug down, all eight pins fell out of the plug. None of the socket pins had sufficient contact pinch to assure a circuit. It took us two weeks to find the specialist who was doing his trouble-shooting with nails, meter probes, bobby pins or anything else readily obtainable. He produced almost as many malfunctions as he fixed.

On today's aircraft with electronic circuits that are holding critical flight controls in delicate electrical balance, the slightest disruption or increase of resistance can bring on interesting results, some of which become classified as accidents or incidents with such words as "Electrical malfunction in the flight control circuit". . . . "The uncommanded flight control actuation caused". . . . "When coming out of the 3G pullup, the rudder would kick". . . . "The flaps would not retract". . . . "The store would not jettison because the electrical connector was worn". . . . "The oil quantity reading was unreliable because of the spreading of the pin contacts on the component module unit. . . ."

Take your pick—they all could be caused by "violated" electrical connectors.

Some of the latest designed "Environmental" connector pins (Fig. 1) have an entrance ring design that limits the size pin that can enter the receptacle. However, many of the aircraft in our inventory still have the early design which can be permanently damaged if stretched or overpressured. Figure 2 shows the "NO-NO" technique of jabbing meter probes into an electrical connector and Figure 3 illustrates the use of the correct size pin being used. While you're looking at the illustrations, notice in Fig. 4 how a meter probe will permanently damage a socket pin and produce a defective electrical circuit that may take weeks to locate.

A good electrician will test the female *socket pin grip tension* of any circuit connection that is acting "goofy" and inconsistent, particularly at plugs that are frequently disconnected. In addition, he will insert the correct size pin in the socket and make the electrical checks from the test pin rather than probing the socket. This is particularly advantageous when making power-on tests when a possibility exists that "welding" damage could occur. The same technique should be used when checking a connector with pins. The proper socket pin with an insulator sleeve, should be slipped over the pin and tests made on the socket.

Do not "poke" in a connector with a meter or electrical power source if there are explosive circuits in the plug. Consult the applicable maintenance manuals for correct technique, meter and cautions.

BENT PINS

It is not uncommon to hear such statements as, "When the switch was actuated for the landing lights, the pylons blew off!"—if a connector was installed with a bent pin that folded over and contacted other circuits. See Fig. 5 for a graphic view of this type of maintenance-caused "fireworks." Take the time to inspect a male plug before connecting to be certain all pins are straight and will enter the sockets without deflecting out of position.

TEST PINS

Figure 6 shows an array of typical test pins which, when used properly, will prevent pin and socket damage. Notice the shrink insulation on the sockets to prevent contact with other pins or sockets.

Another good suggestion is to equip your test meters with newer test probes that are designed to prevent spreading of the sockets beyond their designed spring action.

SPECIFICATIONS

It is very difficult to establish a pin-to-socket engagement and separation force on in-service connectors. Mil-C-005015F mentions minimum separation for a 16 gauge pin is 2 ounces. However, this is a manufacturer's specification and is only given as an example. Also, military standard gauge pin, for socket contact engagement test, MS3197 gives the diameters for the pins that are used as test pins for engagement tests.

CONNECTOR REMOVAL

Broken wires close to an electrical connector can drive a troubleshooter up a wall. One of the main reasons for this can be seen almost every day on the flightline or in the hangar. The technique of removing a threaded retainer-equipped connector by hand invariably causes you to back it out until it loses its slack and then the wire bundle is used as a handle to rock the connector out until the retainer loosens to the hand for another cycle. The next time you do this, take particular notice of the bending action of the wires and visualize how many times the wire can stand that action. *Do not* "attack" a connector from the wire end. If the threaded retainer will not back out the plug by hand, try the special tool designed for this purpose shown in Fig. 7.

Remember:

- *Do not* spread pin sockets.
- Test sockets for proper grip.
- Use specially designed probes or actual pins for test work.
- *Do not* install any connector without first checking for bent pins.
- *Do not* use the wire bundle to aid in removing a connector.

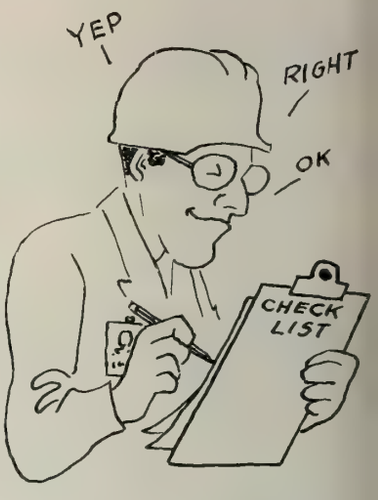
Don't be the "meanest man in town." ★

MISSILE TOPICS



PAINT IS WHERE YOU PUT IT

It takes only a quick look around to see how extensively paint affects our lives. We use paint to beautify our surroundings, protect property from the elements, transmit information, and promote safety. Unfortunately, we sometimes get carried away with paint—and suffer the consequences. Recently, a Thor launch complex was damaged when a "B" nut fractured during pressure checks. The "B" nut failure was due to fine cracks which went undetected under a coat of paint. Another example of improper application of paint occurred on Minuteman payload transporters. Paint was applied to environmental seals, thus promoting deterioration, hindering inspection, and reducing effectiveness. Given a little thought, we can all probably recall instances where paint has been misplaced. The point is, we must be sensitive to this problem and ensure that discrepancies are corrected when the painters get "carried away."

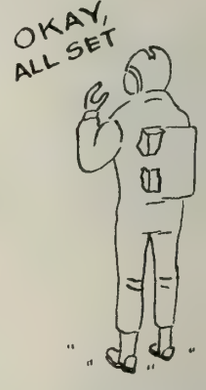


THE BEST ADVICE I EVER HAD

FOLLOW THE TO— DO NOT ATTEMPT TO PERFORM FROM MEMORY. These thoughts, while not new, are superbly expressed in a set of working rules by the 351st SMW Deputy Commander for Maintenance and distributed to each of his maintenance technicians.

DO THE JOB AS YOU WERE TAUGHT TO DO IT. There is no room for uncontrolled innovation in the missile field. A deviation from this precept was the root cause of a recent missile accident.

TAKE NO IMMEDIATE ACTION UNLESS REQUIRED BY TECHNICAL DATA EXCEPT WHEN IT IS OBVIOUS THAT A DELAY WOULD INCREASE THE RISK OF EQUIPMENT DAMAGE OR PERSONNEL INJURY. These vital key words are taken from SAC Regulation 355-3, Missile (ICBM) Potential Hazard System. The regulation was originally inspired by a series of Atlas F accidents in the early 60s, and is one of the best accident prevention documents ever put together. The advice is intended for those people who find themselves confronted with an event which creates a potentially hazardous condition. The regulation furnishes critical guidance to limit damage and effect a safe recovery.



NO MARGIN FOR ERROR

Probably the most dangerous single item on a Titan II complex is propellant. We all know that both the fuel and oxidizer can cause serious injury and even death. Fortunately, personnel who must work around propellant have been provided with adequate protection in the form of procedures as well as protective clothing and breathing devices. If this equipment and the associated safety procedures are not employed properly, the results could be disastrous. If your job even remotely exposes you to this type of danger, make sure you understand how and when to use protective equipment. Technical data provides detailed guidance in this area and it must be followed to the letter. There is simply no margin for error.



LEST WE FORGET . . .

Ten years ago, two Minuteman missiles required recycle after water from melting snow entered the launch facilities and caused the missiles to become wet.

Five years ago, history repeated itself when two Minuteman missiles required recycle after water from melting snow entered the launch facilities and caused the missiles to become wet.

One year ago, failure to detect a bent pin in a Minuteman missile guidance set umbilical cable head resulted in damage to the umbilical connector and a 6-day delay in starting up the launch facility. ★

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ED STATES AIR FORCE

Well Done Award





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Technical Sergeant
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314 Tactical Airlift Wing (TAC)
Little Rock AFB, Jacksonville, Arkansas

The mission was to be a routine, Phase I, initial qualification training sortie for a student crew. Since this was to be the student pilot's first takeoff in a C-130, Captain Long was demonstrating the takeoff. The takeoff progressed normally to the 10,000 feet of runway remaining mark, when TSgt Robertson observed that all four propellers had overspeeded and "pitchlocked." Captain Long decided to abort the takeoff, so he retarded all four throttles to "Flight Idle," but they remained pitchlocked. Captain Long and TSgt Robertson were now faced with an emergency which had no precedence and, therefore, no emergency procedure. With 6000 feet of runway remaining, they shut down the outboard engines by using the "Ground Stop" position. At 3000 feet remaining the ground speed was still high. Faced with the possibility of going off the overrun at a fairly high speed, Captain Long "throttle burst" the two inboard throttles in one final attempt to "break" the pitchlock. This time the effort was successful; the inboard propellers became controllable and were placed into maximum reverse. Captain Long made a highspeed turn onto a runup area and stopped the aircraft without further incident. Captain Long's and TSgt Robertson's professional reaction to a situation that had never occurred before in the history of the C-130 prevented the possible loss of a valuable aircraft and an irreplaceable aircrew. WELL DONE! ★

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Joyce Bellue says buying the equipment is only part of it, you've got to get in condition too.

Photos taken at United Sporting Goods

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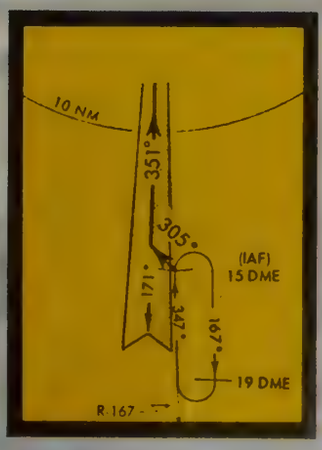
Know Your Altitude



Flying Less . . . and Trying to Enjoy it More

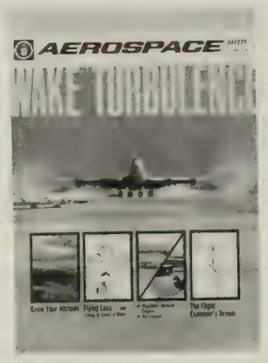


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UNITED STATES AIR FORCE MAY 1975

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MAY 1975 AFRP 127-2 VOLUME 31 NUMBER 5



THE HIDDEN KILLER OF THE AIRWAYS



DR. GEORGE KURYLOWICH
Air Force Flight Dynamics Laboratory (AFSC)
Wright-Patterson AFB OH

Invisible hazards lurk in the airways in the form of the wake generated behind every aircraft. Another aircraft flying into such a hazard can be subjected to large flight path excursions that could result in structural damage to the aircraft or sufficient loss of control to result in a crash.

The hazard is a result of a well-ordered swirling flow generated primarily because of the lift exerted on the wing. As a result, a tornado-like vortex is trailed from the vicinity of each wingtip. It is this well-ordered flow that characterizes the hazard. The flow is more complicated when flaps are down and there is mixing between jet engine exhaust and aircraft drag effects with the vortical flow field; nevertheless, the hazard is still a result of vortices trailed behind the wing.

The vortices can persist for a long time behind the generating aircraft, and are very strong at 10 nautical miles behind a jumbo jet. A measure of the tornado-like strength in these vortices is illustrated by the fact that a smaller aircraft such as a fighter or trainer can be completely inverted in less than one second in the vortices at 10 nautical miles behind a jumbo jet.

IMPACT ON AIR FORCE OPERATIONS

A study performed in 1972 indicates that USAF fighters are also susceptible to this hazard during formation flight. Here, the vehicle generating the vorticity field and the aircraft encountering the hazard are of the same weight and type. During landing or takeoff, sufficient altitude may not be available for recovery after an encounter with a vortex generated by the aircraft ahead. Additional fighter mishaps occur during landings behind transports and during aerial refueling.

The cargo-type aircraft seems to be affected greatly during minimum interval takeoffs (MITO). An example is an accident in which the third C-130 in a MITO formation crashed. The possibility existed that the wingtip vortices from the first two aircraft and the rotor wash from a helicopter may have caused the aircraft to yaw extensively just after lift-off. The accident occurred on a relatively calm morning and the light wind across the runway could have caused the vortices from the first two aircraft to persist in the path of the third.

THE ANATOMY OF AN ACCIDENT

The whole wake-vortex problem received dramatic emphasis by the crash of a T-38 which ended in two fatalities and the loss of the aircraft (Figure 1). This accident should serve as an example to all USAF pilots of the deadly swiftness of events when a trainer or fighter-type aircraft encounters this hazard during landing approach. A reconstruction of the accident is given in Figure 2; it is emphasized that the T-38 crashed approximately 5 seconds after the encounter with the vortical-wake hazard.

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Figure 1 Wreckage of T-38—victim of wake turbulence.

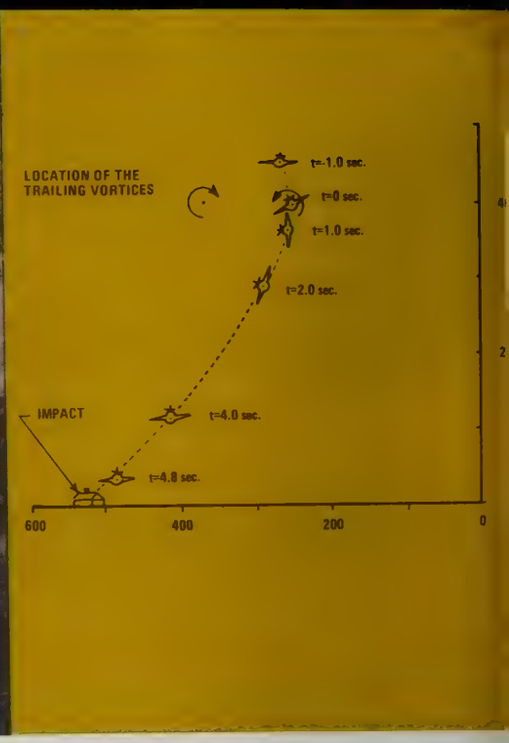


Figure 2 Last few seconds of T-38 flight.

The sequence of events leading to this crash was as follows, according to the findings of investigators and the results from a digital computer simulation of the fateful flight. The T-38 was in the process of performing a TACAN approach prior to landing behind a stretch C-130 transport. Although the T-38 pilot and air traffic control personnel were operating within all applicable directives, theT-38 closed to approximately one minute behind the transport. At this point in time or t = 0 in Figure 2, the T-38 was approximately 2½ miles from touchdown when it penetrated the right-wing vortex trailed behind the C-130.

At one second following the encounter or t = 1.0 in Figure 2, the T-38 banked left-wing-down to an angle greater than 90 degrees despite the efforts of the pilot. This was followed by a rapid decrease in altitude as the pilot attempted to regain a wings-level attitude; the aircraft crashed.

Analysis indicated that the roll moment exerted by the vorticity field of the C-130 exceeded the aileron authority of the T-38 by at least 200%; there was no way to keep the T-38 wings-level following this encounter. In addition, neither the pilot(s) nor control tower personnel were aware of the severity of the situation. Present air traffic control directives provide increased separation to certain fighter and trainer aircraft when an approach is made behind a "heavy" aircraft; by definition, a "heavy" aircraft is one that weighs over 300,000 pounds. Some pilots may harbor the incorrect belief that an approach made behind a stretch C-130 (130,000 lbs.) to be relatively "safe."

THE EFFECT OF WEATHER

The weather at the time of the T-38 accident was considered to be ideal for flying with little or no gustiness and an approximate 3-knot crosswind. Unfortunately, these conditions can cause vortices to persist for a long time in the approach, landing, and takeoff alley.

In short, lack of gusty winds across an airfield can result in a serious wake-vortex hazard persisting over and near a runway. The FAA has conducted an intensive survey of the persistence of vortical wakes in the approach alley at Denver Municipal and Kennedy International airports. The presence of vortices behind the aircraft and in the approach alley was determined by ground-wind anemometers and pulsed acoustical radar. The results indicated that a dangerous vorticity field may remain within the approach alley for more than 90 seconds after the generating aircraft lands, when the prevailing wind is below 9 knots from any direction.

Another factor that can affect the location of the vortical wake is the presence of air density and thermal gradients in the vicinity of the wake; here, the vortices can be influenced by a buoyant force. This force is a result of differences in density between the air swirling in the tornado-like vortex and the air just outside of it. If the air within the vortex is less dense than the atmospheric air, an upward force is exerted on the vortex just as an upward force is exerted on a balloon filled with helium. The density within the vortex can be different from that of the air just outside of it through engine exhaust entrainment or changes in atmospheric

density created by the descent of the wake through a stratified medium.

The effects of buoyant forces can be significant. For example, it has been observed that the vortical wake behaves as though it were approaching the ground when the vortical wake descends towards an inversion layer. That is, the vortices cease their downward motion and spread laterally as the inversion layer is reached.

The fact that density variations in the atmosphere can retard the downward motion of the vorticity field resulted in a T-39 crash landing. The accident occurred during landing approach when the T-39 closed to within 100 seconds (4.0 nautical miles) behind a DC-10. The T-39 was directly behind and between 50 and 100 feet below the DC-10 just prior to the encounter. Upon penetrating the vortical-wake, the T-39 rolled left past 90 degrees and then recovered momentarily. It rolled left again to an almost inverted attitude and then crash-landed just as the pilot had recovered to a wings-level attitude. The point of impact was approximately 3000 feet short and 450 feet to the left of the runway center line. Upon impact, the aircraft skidded approximately 700 feet over a planted wheat field. Luckily, both pilots were able to exit the aircraft through the ground escape hatch.

The atmospheric conditions at the time of this accident were such as to cause the vortical wake to persist for a long time. Also, analysis of existing meteorological conditions indicated that a cold dense air mass in the vicinity of the airfield existed under a warm less-dense air mass containing light prevailing winds. As a result, buoyant forces could have caused the vortices to cease their downward motion and to spread laterally as the density stratification layer between the two air masses was approached.

The effects of density stratification on the trailing vortices behind the DC-10 are shown in Figure 3. Also shown are the altitudes of both the DC-10 and the T-39 when these aircraft passed the 2½ miles-to-touchdown point. If no density stratification were present, the vortices behind the DC-10 would have been at least 280 feet below the T-39 at 2½ miles to touchdown. The presence of the density stratification could have caused the vortices to cease their descent at an altitude of approximately 630 feet resulting in an encounter (Fig. 3B).

THE DAVID AND GOLIATH SYNDROME

Concentration upon operations where a heavy jet may take off ahead of smaller and lighter aircraft has created a David and Goliath syndrome. This syndrome has been fostered by educational films which show that heavy jet aircraft (Goliath) can generate a dangerous vortical wake that can flip a light aircraft like the Cherokee (David). Many pilots are not fully aware that David can slay David. The vortical wake behind a fighter is a potential hazard to another fighter, even when aircraft are of the same weight and type.

At least two cases have been documented where a fighter experienced excessive g-loadings while chasing another fighter; the flight Mach numbers varied from 1.1 to 1.2 at altitudes from 13,000 to 15,000 feet. The conditions under which these events, and others that have been reported, have occurred indicate that the excessive loading is caused by flying through the trail-

Figure 3 Effects of density stratification behind DC-10.

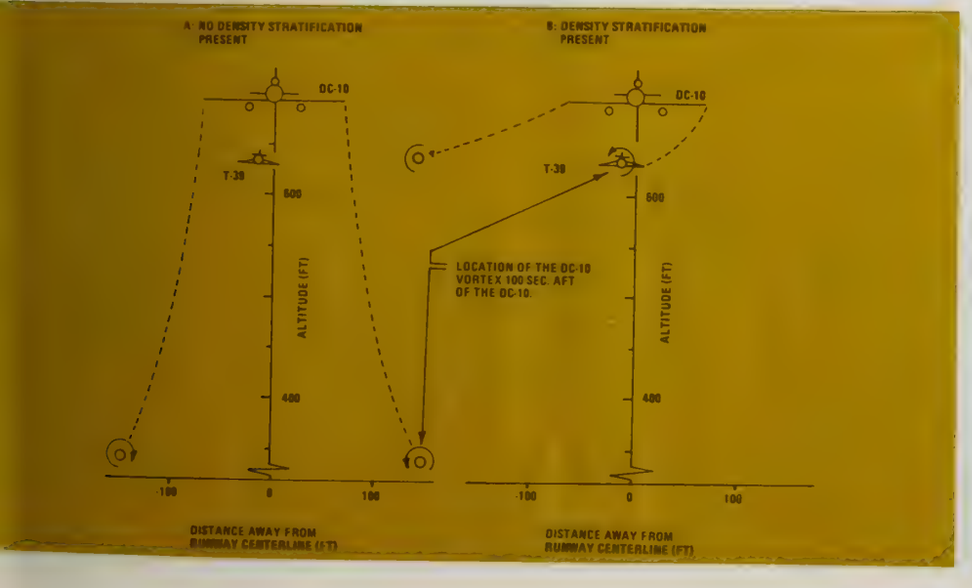






Figure 4 Vortical "bursting" may reduce hazard.

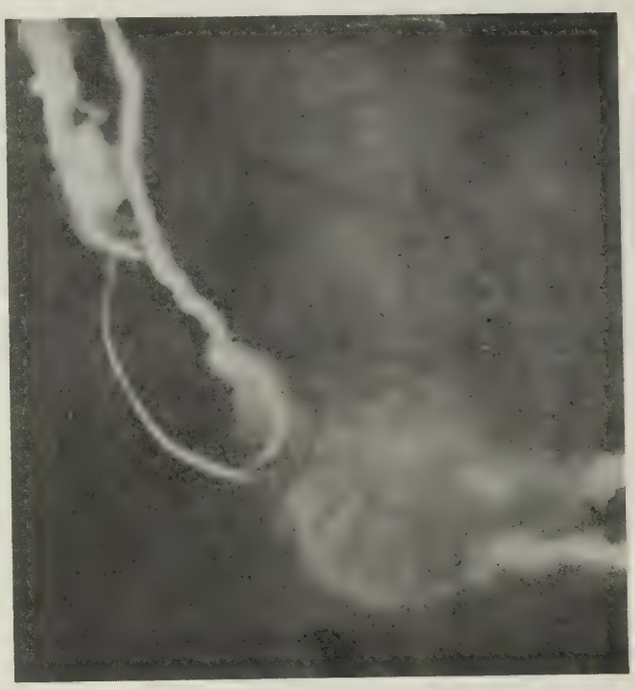


Figure 5 NASA—Langley wingtip mounted spline test aircraft.

ing-vortex wake of the lead airplane. Clearly, the David and Goliath syndrome must be dispelled as soon as possible.

VORTEX ABATEMENT

Wingtip vortices are generated into an atmosphere that is rarely still. Thermals, temperature inversions, and prevailing winds which include updrafts and downdrafts have an effect on these vortices that cause their decay and eventual change into a form of clear air turbulence. In many instances, the atmosphere has caused the wingtip vortices to burst. The phenomenon of bursting is defined as the process of change within the vortical flow field that causes a marked increase in the vortex radius and/or a significant restructuring of the wake vorticity behind an aircraft. The manifestation of vortex bursting at some location along the vortices hastens the interplay between the vortical wake and the atmosphere and may significantly reduce the vortical wake hazard (Figure 4).

Innovators have suggested schemes or abatement devices whereby the vortex might be bursted prematurely thus reducing the hazard significantly in the terminal area. These abatement devices consisted of: (1) wingtip sculpturing; (2) the blowing of auxiliary air from the generating wingtip into the vicinity of the

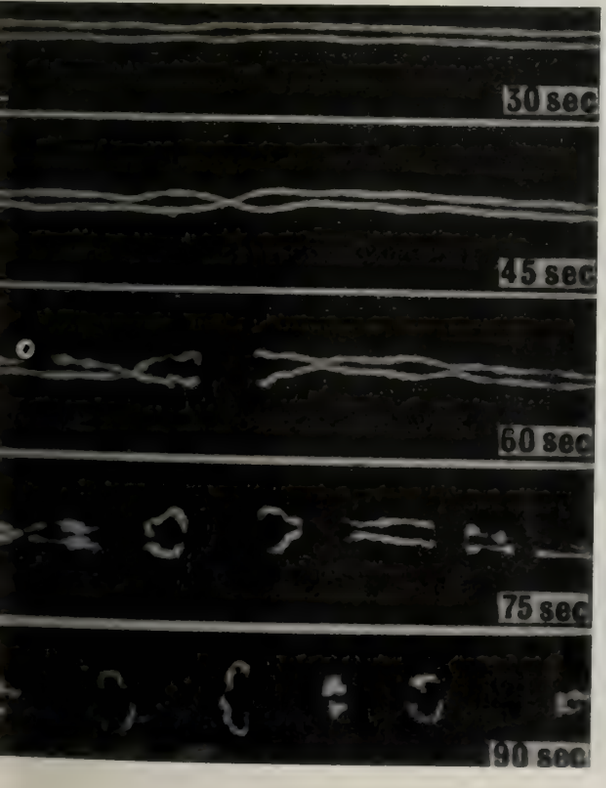


vortex; (3) the use of end plates, vortex generators, tip fences and tip spoilers; and (4) the use of splines (Figure 5).

In addition to bursting, the wingtip vortices can become unstable through natural atmospheric interferences by oscillating relative to one another as shown in Figure 6. As shown, the amplitude of the oscillation increases until the vortices touch. When this occurs, the vortices form rings and then diffuse into the atmosphere as a form of clear air turbulence. Again, innovators have suggested that this form of unstability be induced prematurely for purposes of reducing the hazard to following aircraft.

Of importance, as well, is the evaluation of new systems that may be used in future USAF operations. For example, the Microwave Landing System (MLS) is currently being developed for near future use in automatic landings. By means of this and similar systems it is projected that safe landings can be made in foggy weather; but the atmospheric conditions that cause fog to persist are exactly those that cause the vortical wake to exist for a long period of time. In an aircraft equipped with an automatic landing system that automatically maintains a wings-level attitude during the approach, the pilot may not be aware that he is encountering the vortices until the ailerons hit their deflection stops and the aircraft begins to roll.

Figure 6 Vortical wake instability behind a B-47.



Furthermore, there are operational problems and missions of specific interest to the USAF such as aerial refueling, minimum interval takeoffs and formation flight. These operations are performed only by the military, and advisories and educational summaries are required for the military.

A concerted USAF effort is necessary to reduce the probability of accidents resulting from wake turbulence encounters. This program should include, among other things, strict adherence to the provisions of FLIP General Planning and the recommendations contained in the ALMAJCOM of 15 Jan 75, Subject: Wake Turbulence. Those recommendations are quoted as follows:

"A. PILOTS SHALL APPLY THE DISTANCE OR TIME INTERVALS SPECIFIED FOR USAF IFR OPERATIONS WHEN CONDUCTING VFR FLIGHT BEHIND JUMBO JETS. TOUCH-AND-GO LANDINGS ARE PROHIBITED BY USAF AIRCRAFT, EXCEPT HEAVY JETS, WHEN JUMBO JETS ARE OPERATING IN THE TOWER TRAFFIC PATTERN. LOW APPROACHES BEHIND JUMBO JETS WILL BE FLOWN NO LOWER THAN THAT ALTITUDE WHICH INSURES THAT THE USAF AIRCRAFT REMAINS WELL ABOVE THE FLIGHT PATH OF THE JUMBO JET.

B. USAF PILOTS OF OTHER THAN HEAVY AIRCRAFT OPERATING IFR INTO US CIVIL AIRPORTS SHALL REQUEST THE APPROACH CONTROL TO PROVIDE TEN MILES OR FOUR MINUTES SEPARATION BEHIND JUMBO JETS.

C. EACH MAJCOM SHALL ESTABLISH A PROGRAM TO INSURE THAT ALL PILOTS RECEIVE AT LEAST SEMI-ANNUAL TRAINING ON THE WAKE TURBULENCE HAZARD. EMPHASIS SHALL BE PLACED ON THOSE ASPECTS PECULIAR TO THE MAJCOM FLYING MISSION. AFM 51-12, AFP 60-19 (VOL I), AIR TRAINING COMMAND PAMPHLET 51-12, THE AIRMEN'S INFORMATION MANUAL, AND FAA ADVISORY CIRCULAR 90-23D PROVIDE EXCELLENT INFORMATION ON WHICH TO BASE SUCH A PROGRAM.

D. THESE INSTRUCTIONS ARE INTENDED TO EXPAND AND AMPLIFY WAKE TURBULENCE AVOIDANCE GUIDANCE AND DO NOT REPLACE CURRENT PROCEDURES AND CRITERIA, WHICH REMAIN IN EFFECT." ★



who is flying this bird?

SIMULATOR SINS

CAPTAIN ALLAN K. MacAULAY
1550 TTS
Hill AFB UT



Misunderstanding resulted in neither pilot flying the helicopter. Fatal, perhaps, if it had not happened in a simulator.

The investigating team was perplexed. After an exhaustive examination of the wreckage, they could find no hard evidence as to what had caused the loss of a mulitmillion dollar aircraft and the death of three crewmembers. Weeks of sifting wreckage and an in-depth study of the crew's background experience had produced no obvious cause. The only abnormal finding was the fact that AFCS (automatic flight control system) servos had been turned off—nothing could be found wrong with these servos. Why had the servos been turned off? What had caused this aircraft to crash?

Had a flight recorder been on board, it would have revealed the following scenario. Jolly 99 was in a holding pattern at 1800 feet, IFR—initial outbound leg. The copilot was flying the aircraft while the pilot was briefing the upcoming instrument approach.

Copilot, "Turning right inbound."

Pilot, "It's a left turn."

Copilot, "No, we're in holding."

Pilot, "Let me check—oh yes, I've got it." (Meaning yes, I see that a right turn is correct.)

Copilot, "Roger, you've got it." (Meaning you've got the controls—no visual confirmation.)

The aircraft was now in a standard right turn, trimmed, with no one monitoring the controls.

Flight Mechanic, "Shouldn't someone be on the controls?"

At this time the pilot, realizing that no one was flying the aircraft, leaped on the controls, released the trim and proceeded to put the aircraft through several severe maneuvers (pilot induced).

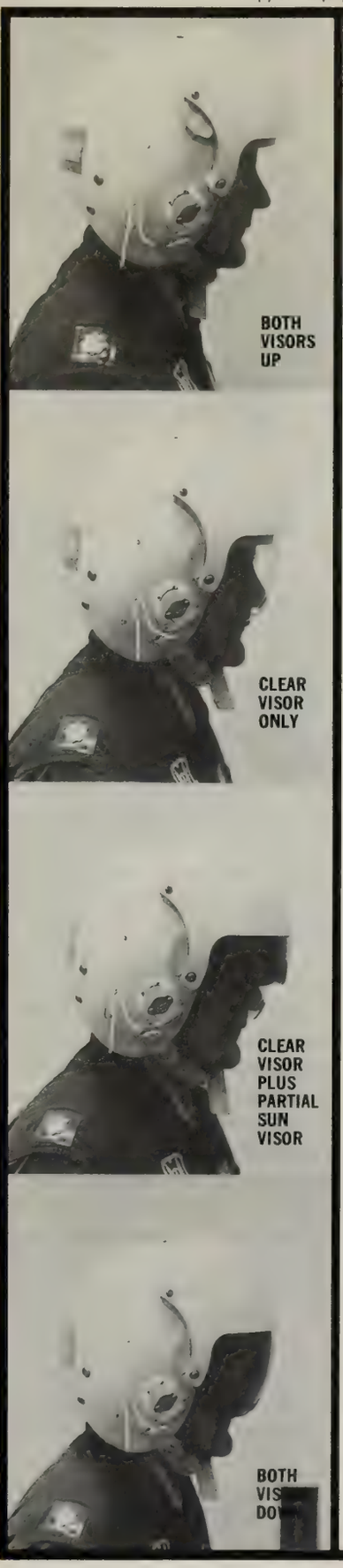
Pilot, "I think there is an AFCS problem—shut the AFCS servos off!" (There was no malfunction, the copilot shut off the AFCS.)

With the automatic flight control system off the pilot had even more difficulty with the aircraft—bank angles exceeded 90°. The copilot did not take the controls, although it was obvious that the pilot could not control the aircraft. Result: The aircraft crashed from an 1800 foot holding pattern with no malfunctions.

The preceding episode actually happened—well, at least the inflight portion did. The aircraft investigation part was fabricated. It happened during a helicopter simulator flight at Hill AFB. The pilots were qualified crew members who were attending the annual HH-53C simulator refresher course. Crew coordination, or rather the lack of crew coordination, was the cause of this "mishap."

This may well have been only a simulator flight but you can be certain that these crew members learned a great deal from these events. The necessity for close crew coordination has been deeply etched in their minds and a major objective of the annual refresher training has been achieved. ★

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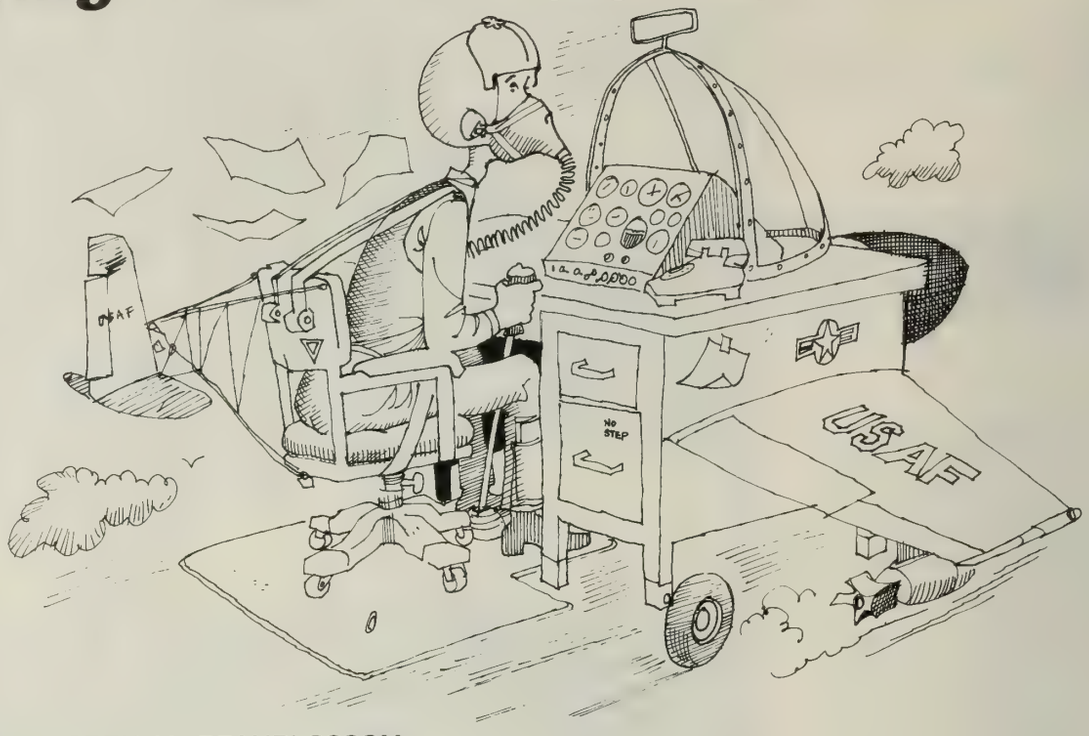
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CAPTAIN BOBBY V. BEANBLOSSOM
Air Force Inspection and Safety Center

". . . Extraordinary management actions are required to ensure each minute of time spent in the air contributes to mission effectiveness . . . Emphasis must be placed on quality training and not flying hour production."

If this quote from a recent USAF/CV ALMAJCOM message doesn't convince you it's time to maximize the value of *every minute* you're airborne, then take ten minutes and talk to those pilots who are limited to six missions per quarter. They'll be short and to the point . . . "It's damn tough keeping up with and getting comfortable in any aircraft with only two missions every thirty days."

During my recent command post tour, which allowed only limited flying, I used some techniques to maximize the few times I could fly. Based on that tour and numerous conversations with staff officers/pilots facing the same problem, the following suggestions may help you make the most of every minute you're in the seat.

I've aimed these suggestions primarily at those restricted to six missions per quarter, but with the "lean and mean" flying hour program across the Air Force, you line jocks should find some helpful hints for today—and for future assignments.

FLY A WISE SCHEDULE

As always, a good flight starts on the ground . . . through complete preflight preparation. But for the restricted flyer it must start before the pre-mission study and briefing. The first step should involve the scheduler. If you're flying only twice a month, then try to fly every two weeks. Don't go 20+ days between flights. FLY AT CONSISTENT INTERVALS.

Next, schedule permitting, fly the multi-sortie missions and devote your flying day to flying. Twice a month, the office must become a secondary mission. FLY ON YOUR FLYING DAYS.

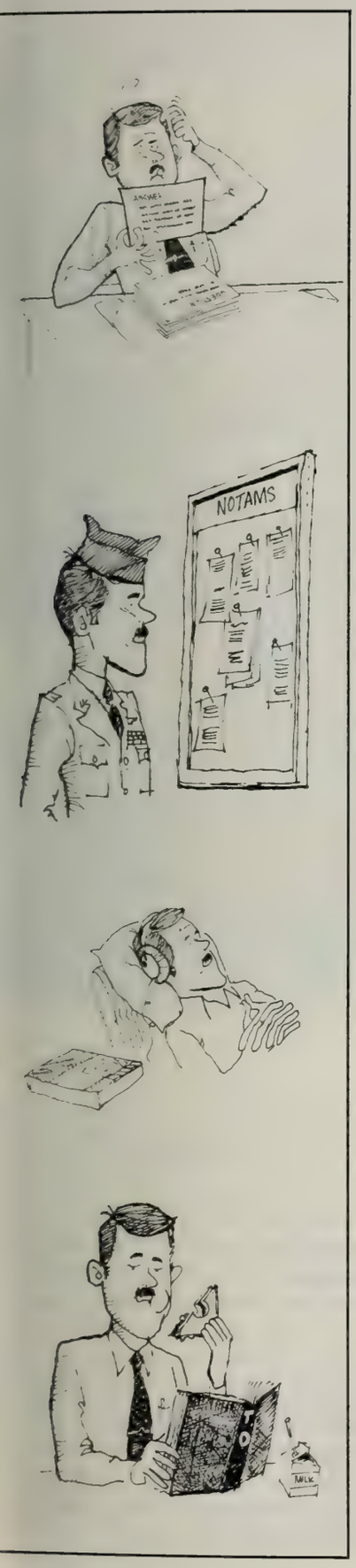
Finally, request occasional flights with instructor pilots. They can help repolish your under-used flying abilities. Additionally, you won't be restricted from accomplishing specific flying events when under the supervision of an IP. FLY WITH AN IP.

You must take time and effort with your flying schedule. If you'll fly the right missions some of the time, your flying will be even more enjoyable and *productive.*

REVIEW MANUALS CONSISTENTLY

After optimizing your flying schedule, the next step is effective pre-mission study. Although better than no studying at all, the "night before" dash 1 cram session is not the long lasting solution. You should attempt to review your manuals frequently. I planned on once a week. Pick an evening to look through the dash 1, AFM 51-37, AFR 60-16, and those various Command directives. Highlighting and underlining in any manuals can speed the review.

In addition to a weekly review, I developed a set of 5 x 8 cards with significant facts and figures from



all the manuals, everything from basic systems information to fluctuation limitations. I also developed a few cards for 51-37 with those sometimes-hard-to-recall phrases—"at or below," "on course inbound" and "within one dot deflection." I kept these cards at my desk and ran through them periodically. Additionally, a 5 x 8 bold face procedures card was in constant view on my desk top. Another study gimmick suggested by a desk ridden pilot was to convert (design) your desk blotter into a study guide. Another staff officer/pilot suggested a self designed tape recording with all the facts and figures. He goes home, sits back and relaxes, puts on the stereo headset and absorbs. The point is, you must increase your exposure to your aircraft limitations and systems if you're flying less. INCREASE YOUR AIRCRAFT STUDY.

There is a practical limit on the productivity of good preflight studying—sort of a "law of diminishing returns." The busy staff officer, of course, wants to use his available time for studying to the maximum *effective* extent. Once a study routine is established, the limited flyer should consider one further preflight step.

Today's Air Force is looking more and more toward simulators and trainers. I've found them invaluable. You don't need to spend the entire afternoon at the trainer—only 30 minutes if you have it. In fact, I've found that about 45 minutes of concentrated work can be a productive period of review. I slip in between regularly scheduled flights or during lunch. Actually, getting away from the desk for an hour during the week can be very refreshing, and it will make those twice a month flights even more productive. UTILIZE AVAILABLE SIMULATORS/TRAINERS.

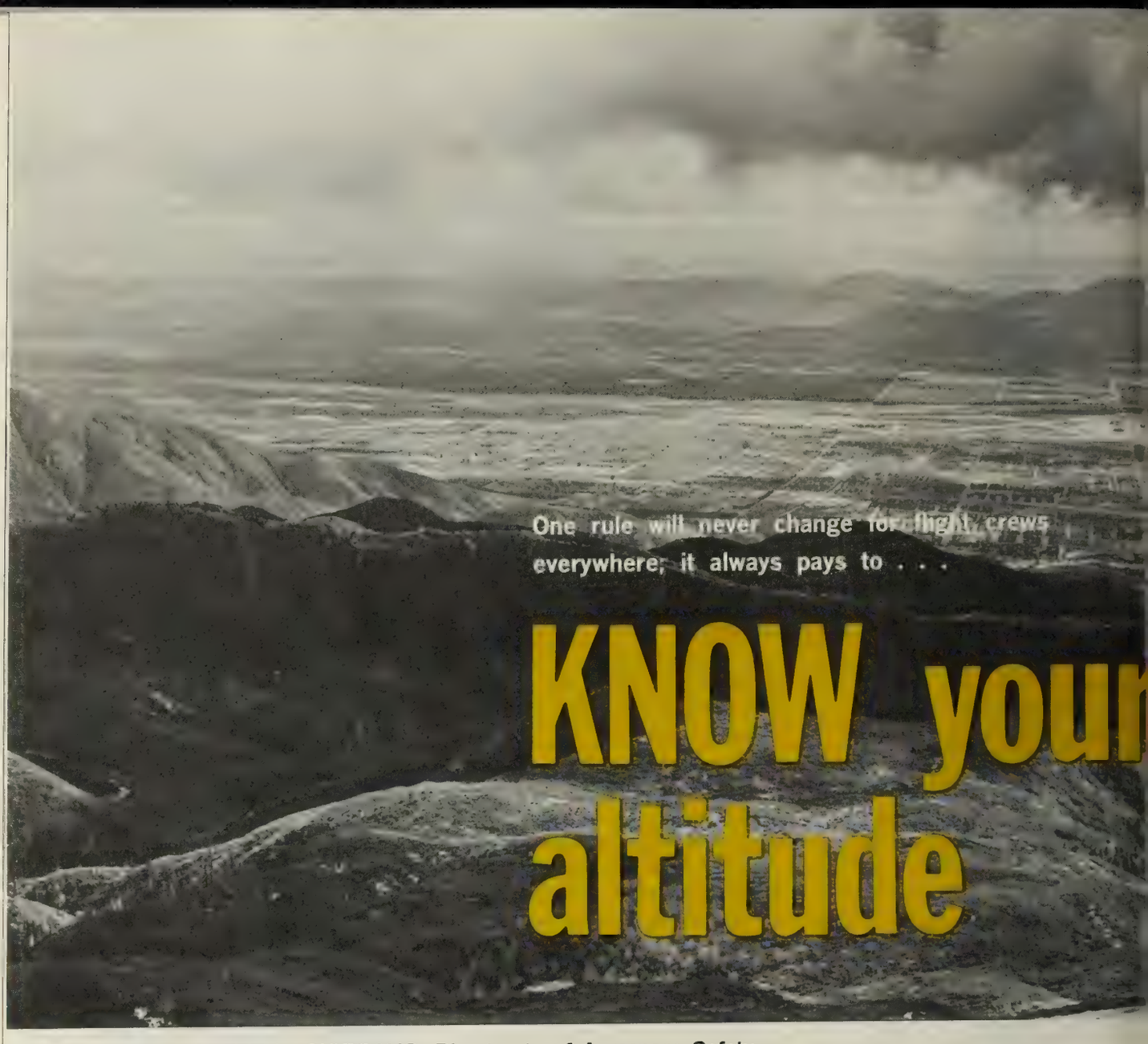
Once you've academically prepared yourself to fly, the next step is to maximize your flying time. The restricted flyer must allow himself *extra* time at Base Ops and the squadron. Getting up to speed on the FCIF, crew bulletins, etc., just takes more time. I found that stopping in after work the day before works well. But, when that is impossible, you should plan to show up early. ALLOW MORE FLIGHT PLANNING TIME.

The preflight briefing has to be more comprehensive and thorough if you're flying less. Tell the AC or flight lead about your situation, when you last flew, etc. Don't try to fool anyone—they'll find out soon enough anyway. Allow yourself a little more time for preflight and getting things squared away. Once you release brakes, you've got to be ready to fly. It's getting a little late then to do any catching up. EXPAND BRIEFING AND PREFLIGHT TIME.

Once airborne, you should give yourself as much opportunity for training as possible. Fly different types of approaches. Set your standards high and when you reach your goal set them higher. Avoid use of the autopilot, if you have one, unless flying in a high-density traffic area where collision avoidance is a factor. Basic instruments get rusty when you are 15 days between flights.

The final step to the effective flight is the debrief. Debriefs don't have to be long. They need to be complete and candid. Ask your AC or flight lead for comments. Be honest with yourself also. If you're not hacking the program, then go back to the basics and seriously analyze your problems.

Remember our mission really is . . . "TO FLY AND TO FIGHT." Maximizing the productivity of every minute of flight, by using some of my ideas or your own, is the personal responsibility of each Air Force pilot. It's like "bombs on target," "on time takeoffs," "a successful intercept," "soloing your student" . . . just one more aspect of being a PROFESSIONAL. ★



LT COL ROBERT L. GIORDANO, Directorate of Aerospace Safety

DOD FLIP, Planning Section III, International Rules and Procedures, Paragraph III B 3, describes pilot responsibility for terrain avoidance when operating in accordance with instrument flight rules.

"Except when necessary for take-off or landing, or except when specifically authorized by the appropriate authority, an IFR flight shall be flown at a level which is not below the minimum flight altitude established by the State whose territory is overflown, or where no such minimum flight altitude has been established.

(1) Over high terrain or in mountainous areas, at a level which is at least 600 meters (2000 feet) above the highest obstacle located within 8 Km (5 statute miles) of the estimated position of the aircraft.

(2) Elsewhere than as in (1) above, at a level which is at least 300 meters (1000 feet) above the highest obstacle located within 8 KM (5 statute miles) of the estimated position of the aircraft.

NOTE: The objectives of the air traffic control service do not include prevention of collision with terrain. No procedure prescribed herein will, therefore, relieve the pilot of his responsibility of ensuring that any clearances issued by air traffic control units are safe in this respect, except in the case of an IFR flight which is vectored by radar."

That is pretty heavy jargon, and it may come as a shock to many aircrew members, particularly when we realize that air traffic control systems, like weapon systems, involve humans and equipment that can only *approach* perfection. So it pays to know your position and your height to avoid threatening terrain. But, that was the bad news first.

Published routes and airways, approach and departure procedures and radar vector service temper, to some extent, that stark pilot responsibility if operating in accordance with an IFR clearance. The key is to know when the tempering conditions apply—or ask.

We will examine three phases of IFR flight: Departure, Enroute and Arrival. For VFR flight, suffice to say, you must avoid obstacles such as persons, vessels, vehicles, structures by 500 feet vertically and any congested area of a city, town or settlement, or over an open air assembly of persons by 1000 feet vertically and 2000 feet horizontally, etc. Refer to Federal Aviation Regulation (FAR) Part 91, para 91.79. Generally, the minimum safe altitude rules for VFR in the United States will be almost identical to those of other nations. These rules always apply, except for takeoff or landing.

The minimum altitudes for the departure phase are not clear for most airdromes. Airports operated by the USAF have specific obstruction clearance requirements for publishing Standard Instrument Departures. (A typical DOD standard instrument departure procedure will include a rate of climb required to assure obstacle clearance in the event more than 150 feet of climb per nautical mile is required—AFR 60-27.) The remainder of the airdromes in the world do not have specific obstruction clearance criteria for departures or Standard Instrument Departures. Obstruction clearance must be determined by the pilot at all airports, even if they have a SID published, unless it is a SID published under USAF authority.

The enroute phase rules are clear for flying on published routes. An aircraft that remains within the limits of the published air traffic service (ATS) route width will be provided the required obstruction clearance so long as the appropriate altimeter setting and published minimum altitude or flight level is complied with. Each state in ICAO has an appropriate authority that is responsible for ensuring that the published minimum altitudes on their ATS routes are correct. Also, air traffic controllers must know the minimum altitudes for their area of responsibility and may not issue an altitude clearance below the published minimum altitude.

The enroute phase, off of published ATS routes, requires the same minimum altitude as the published ATS routes do, but now the aviator may get into the computation of minimum altitudes. He must determine the minimum altitude for a proposed route of flight that is not published, especially for flight in uncontrolled airspace. If the air traffic controller issues a clearance for a route that is not published, he must determine what minimum altitude is applicable only in controlled airspace. However, it is still advisable to look at a sectional and compute what the minimum altitude should be. If you have any questions, *ask the controller.*

The arrival phase is clear when the interface between enroute and arrival is via published ATS routes. Any deviation from published routes/approach procedures gets into split responsibilities between pilot and controller. The obstruction clearance areas, vertical and horizontal for published instrument approaches, decrease from the initial approach fix inbound; therefore the minimum altitude(s) specified on the chart, and the lateral area that is protected, become more critical as you approach the airport.

Radar air traffic services cross all three phases of flight in controlled airspace. When radar vectoring an IFR flight off of an ATS route, the controller shall ensure that adequate terrain clearance will exist at all times by issuing an appropriate altitude until the aircraft reaches the point where the pilot will resume his own navigation via a published ATS route.

On departure, a vector may be issued *before* the aircraft reaches the minimum vectoring altitude, if the vector is away from any obstruction which is displayed within 3 miles either side of the route of flight. Enroute, and while in the terminal area, at the minimum radar vectoring altitude, 1000 feet of obstruction clearance is provided by air traffic services.

The pilot has no way of knowing what the minimum radar vectoring altitude is for the area in which this service is authorized. The pilot can ask. The pilot can look at a sectional and add 1000 feet to the highest obstruction within 3 miles of his route of flight. The pilot can trust the radar controller, but should not be ashamed to confirm an altitude or that radar vectors are being provided. The interface between the radar vector and the place where the pilot assumes responsibility for his own navigation, lateral and vertical, by virtue of acknowledging a clearance, e.g., an approach, is not quite clear. The procedure is not precise, if any small segment of either controller or pilot compliance is omitted. Therefore, do not descend until you are on a navigational course published for the approach, then follow the published altitude procedure requirements or limitations. If you are wondering, ask the controller what minimum altitude is applicable or required to provide obstruction clearance.

The pilot in command of an aircraft is directly responsible for, and is the final authority as to the operation of that aircraft. ★

This article was assembled from information provided by AFXOOFSA, HQ AFCS and AFIFC—Ed.

HISTORIC HOLOCAUST

MR. HY BOSCH
Directorate of Aerospace Safety

CUBA
..May 18, 1910



ERROR IN JUDGEMENT

Panic from real or imagined dangers often causes rational individuals to take unreasonable risks. On May 18, 1910, the earth was due to pass through the tail of Halley's Comet. Although this phenomenon occurs every 76 years, on that occasion it was pessimistically predicted that the world's population would die due to deadly gases coming from the comet. Don't laugh. People in a more sophisticated time—1969—believed California was to sink below the water as a result of earthquakes.

Coincidentally May 18, 1910, was also rumored to be the date Cuban revolutionists would attempt an uprising. Worried that dynamite, used for road building projects, might fall into the hands of the insurrectionists, government officials ordered the explosives confiscated. Instead of immediately placing the dynamite in explosives facilities, they chose the expediency of storing it where it would be secure. Thus, some 3000 pounds of dynamite seized in the province of Pinar Del Rio was placed in a room within a massive barracks overlooking a major city. In an adjacent room was 1800 pounds of gunpowder left over from the time Spain ruled the island. The containers of powder were in a sad state of repair and some of the powder had spilled onto the floor.

Worse yet, the barracks containing these explosives were being used to house public works employees, the Rural Guard, and the officers' families. *This was tantamount to storing high explosives in an area exposing Civil Engineer shops, Security Police barracks and the base housing area.*

Finally, wiser heads realized the explosives properly belonged in storage magazines where it would be secure without violating anyone's safety. Due to poor planning and control, the thought was better than the deeds. Workmen assigned to load the powder on carts were seen smoking in the powder strewn area. A carpenter was observed driving nails into the leaking and broken containers. It was little wonder the sensitive explosives went high-order.

The wall between the powder and dynamite was blown down and a second explosion resulted. Only the massive construction of the barracks limited some of the explosives' lethal effects. Still, some 47 men, women and children were killed and 115 others injured. Troops were rushed from Havana only to find the disaster was not due to revolutionary action.

In recent years military arms, ammunition and explosives have become targets for theft by modern day "revolutionary" organizations and individuals. We must not be panicked into placing security or safety over one another. All aspects of both requirements must be considered. At Pinar Del Rio this was not done. This proved to be a fatal error in judgement. ★

THE IFC APPROACH

By the USAF Instrument Flight Center, Randolph AFB, Texas 78148

Q: What is an option approach?

A: An OPTION APPROACH is a recently devised procedure wherein the control tower issues a final approach/landing carte blanche to the requesting aircraft, i.e., without a further statement of intent to the tower, a pilot is cleared to execute a low approach, missed approach, touch-and-go, stop-and-go, or full-stop landing. Its primary purpose is to introduce realism into a training environment, particularly flight evaluation situations. An advantage of the option approach is that the instructor/examiner can see how the trainee/examinee reacts to different situations. Option approaches are authorized only at airfields with an operational control tower and will be subject to air traffic control (ATC) approval/disapproval. The request for an option approach should be made to the approach/tower controller no later than the final approach fix (FAF) inbound on an instrument approach or when entering downwind for a VFR traffic pattern.

Q: What is a contact approach?

A: A CONTACT APPROACH allows an aircraft on an IFR flight plan in *IFR conditions* to deviate from a published instrument approach procedure and proceed to the destination airport by visual reference to the ground. An ATC clearance is necessary and will be issued to an aircraft for a contact approach providing the following conditions are met:

1. The pilot has specifically requested a contact approach.
2. The aircraft is operating clear of clouds.
3. The reported ground visibility is at least one statute mile.
4. Standard IFR separation can be maintained between the aircraft and other IFR or special VFR traffic.

Pilots should understand that clearance for a contact approach does not constitute cancellation of your IFR flight plan. However, by electing to conduct a contact approach, the pilot assumes responsibility for both navigation and obstacle clearance to the airport. Accordingly, controllers will not in any way initiate or suggest a contact approach to the pilot. The contact approach should be considered only as an alternative for a prescribed instrument approach procedure. When situations occur preventing/delaying a complete instrument approach procedure, e.g., NAVAID failure, radar outage, excessive approach delays, minimum fuel condition, etc., pilots might consider a contact approach to permit mission completion and minimize IFR traffic congestion. However, should weather conditions deteriorate so that ground reference is impossible and/or a missed approach is necessary, the pilot should initiate an immediate climb and contact approach control with intentions and/or comply with previous controller instructions.

Q: What, then, is a visual approach?

A: A VISUAL APPROACH is an approach wherein an aircraft on an IFR flight plan operating in *VFR conditions* and being provided radar service may deviate from an instrument approach procedure and proceed to destination airport by visual reference to the ground. The controller, prior to issuing clearance for a visual approach, must ensure the following conditions are met:

1. A reported ceiling exists of at least 500 feet above the minimum vectoring altitude and a ground visibility of at least 3 statute miles.
2. Standard radar separation, i.e., either three miles laterally by radar, or 1000' vertically, is provided from all other IFR traffic until visual separation can be provided.
3. The aircraft reports the airport in sight. Visual separation between aircraft is applied by either an air traffic controller or a pilot. In order for the approach/tower controller to use the term "visual," he must actually see the aircraft either on radar or visually and issue information and instructions, as necessary, to ensure that the aircraft avoid each other. A pilot, by accepting traffic information and instructions to follow another aircraft, acknowledges that he sees the other aircraft and will provide his own visual and wake turbulence separation. Pilots may expect radar traffic information on conflicting VFR traffic but will not be vectored for separation purposes unless specifically requested. Remember, the hemispherical altitude rule for VFR traffic is not applicable below 3000' AGL. The point at which pilots are instructed to contact the tower will vary depending on the runway in use, weather, traffic, etc., and is determined by prior coordination between the approach and tower controllers. Ordinarily, the changeover occurs at least 5 miles from the runway.

Do you have any suggestions/techniques about instrument flight? We may be able to use them. Questions about instrument flight? We may be able to answer them. White to USAFIFC/FS, Randolph AFB TX 78148; or call AUTOVON 487-4276 (Directives), or 4274 (Procedures). ★



You'd better believe

One of the more enjoyable aspects of flying is facing the challenge of a low level route. Smoking along a short height above treetop level, trying to figure out where you are and where you are going, is always a thrill. And if you are flying a B-52, which has a wing span of 185 feet, you are just a little more than four wing spans above the terrain.

By now, you're probably wondering what the topic of this article is.

Maybe crew coordination? Six people talking on the interphone sounds like a national convention.

Maybe the topic concerns proper procedures for exiting low level due to an emergency or bad weather.

Or how about the importance of scanning outside the cockpit so you can avoid the other guy who is trying to fly into you?

Nope. All of these would be fine topics, but this time it's fire warning lights.

Here we are, back in the cockpit at low level. While coping with a myriad of problems, all you need is a fire light. But there it is—bright as the morning sun. Sometimes it might be dim or flickering. The good books says the first thing to do is "Stop—think—collect your wits." All aviators know that you really can't stop. You have to keep flying the airplane. What is meant is, that you must start the problem solving process.

The first step, and most critical, is to identify the problem. You have a fire light, and you would like to confirm that there is a problem. After all, it might be just another false warning light. Sighting of flames or smoke would certainly confirm the light is for real.

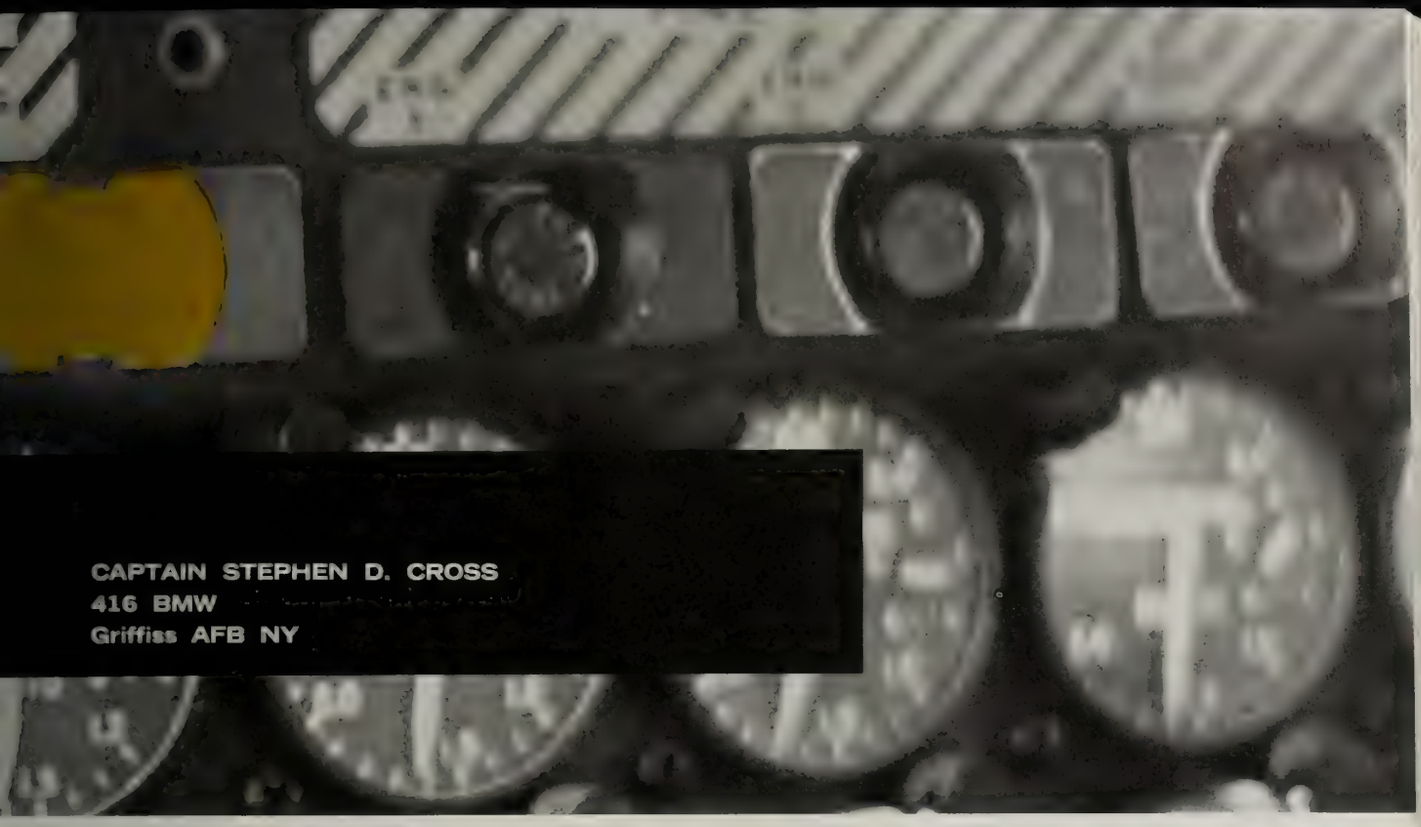
Failing to find visual indications of a fire, you proceed to check your engine parameters. Depending on type of aircraft, they might include RPM, oil pressure, fuel flow, exhaust pressure ratio, and exhaust gas temperature. Abnormal indication of these parameters could indicate any number of failures that would cause a fire light.

Internal failure of the engine may affect all parameters. Increased fuel flow might indicate a break in the fuel manifold. Decreased oil pressure might indicate an oil line break. You could have a loose "B" nut or a faulty quick disconnect. In any event, you probably have a source of fuel for a fire. A high exhaust gas temperature would confirm a problem.

In each of these scenarios, you have been able to confirm the fire light. You have identified the problem. Next step is to analyze the possible solutions and take action that will provide optimum results.

The action taken will, of course, vary with circumstances and type of aircraft. Shutting down the J57 engine on an F-100 will certainly yield different results from shutting down the J57 on a B-52. Another gem from the good book reads: *A thorough evaluation of each emergency should be made prior to initiating action.*

Let's backtrack a moment. Suppose the only indication available is a fire light, and all engine instruments are in normal operating range. What now my friend? Must



CAPTAIN STEPHEN D. CROSS
416 BMW
Griffiss AFB NY

be a false fire light, right? Not necessarily so.

You might have a bleed air leak. Most jet aircraft have some type of bleed air system. Hot, high pressure air is taken off the compressor section and is used for air conditioning, anti-icing, and pressurization of other systems. The temperature of the hot air from the compressor can vary from 450° to 805° F, depending on conditions. If your bleed ducting springs a leak you could have a handful of trouble. Intermittent or continuous operation of the engine fire warning lights or erratic operation of the engine instruments may be an indication of burned or scorched electrical wire bundles as a result of a bleed air manifold pneumatic duct failure. The hot air can melt aircraft structures. Below 25,000 feet, there is a possibility of autoignition of fuel vapors when temperatures are above 475° F. That could mean a full stop in mid-air.

The ducts are more apt to fail during high thrust settings, such as low level and traffic pattern operations.

Statistics are not available on the occurrence rate of false fire lights. Regardless, in many cases, it is difficult to distinguish between a false fire light, and an air bleed pneumatic duct failure. If you have a fire light, you had better believe it. Then you can continue with your problem solving process and take appropriate action.

This means complying with dash 1 procedures for a fire as in the following three cases.

During flap retraction at 1000 feet AGL in a B-52, the nr 7 engine fire warning illuminated. The throttle was immediately retarded and the light flickered and went out. The engine was then shut down according to tech order procedures. *The other engine instruments revealed no indications of fire.* Gross weight was adjusted, Hotel Conference convened and the aircraft recovered. The cause was a leaking pressure and distribution valve seal which subsequently ignited.

In another B-52, the nr 8 engine fire warning light illuminated during departure. *The EGT, rpm and fuel flow indicated normal in climb and idle power settings with the fire warning light remaining illuminated.* The engine was shut down and an uneventful landing accomplished. The most probable cause was a leaking fuel pressurizing and dump valve.

Numbers 3 and 4 engines were shut down for fire warning indications. Damage consisted of a ruptured 16th stage bleed air duct and sheet metal warping of the firewall.

Maintenance can help by increasing the reliability of our fire warning systems so the system doesn't get a reputation for crying wolf. We've had some false warnings caused by crimped or chafed cables as a result of poor maintenance and inspections. Corrosion of the fire warning connectors and control boxes has also caused false warnings. Regardless, when that red light comes on, assume it's real. Let's get it on the ground, and then decide if the fire warning light was false. ★

OPS TOPICS

ONE MORE TIME

These are some of the findings of a recent major accident.

- There were no aircraft system malfunctions which contributed to the accident.
- The pilot violated an acknowledged altitude restriction
- The pilot became engrossed in tracking an unfamiliar moving target and pressed the attack to a point where safe recovery was questionable.
- The pilot did not recognize the seriousness of his position relative to the ground and did not use optimum G for recovery.

A DIFFERENT SORT OF FOD

During the T-Bird's landing rollout, it struck a B-52 pilo chute canister that was lying on the runway. Darkness prevented the pilot from seeing the object in time to avoid it.

CHECK FLYING BOOTS



The new summer weight insulated flying boots have a metal slide lock device which eliminates the need to tie the laces. The laces and locking device provide for quick donning and have replaced the zippers on earlier boots. The device works well; however, the slide bar nut frequently works loose and it is suspected some of the slide bars and nuts have been lost in aircraft cockpits. The life support SPO says that aircrewmen with these new boots should have the bolts peened to the nuts and Locktite applied prior to use.

CB IS BAD NEWS



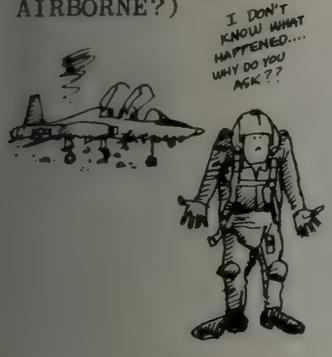
Just after lift-off the KC-135 crew had a very nasty surprise. The chlorobromomethane (CB) fire extinguisher located just above the crew entrance hatch fell out of its storage bracket and landed on the valve assembly, causing the agent to discharge. The force of the discharge caused the extinguisher to spin in a circle spraying the crew compartment. Two crewmembers were hit in the back with the spray. The boom operator was temporarily blinded by the spray when he grabbed the extinguisher and inverted it, bleeding off the pressure. Fortunately, the pilots were not incapacitated and made a safe landing before the CB agent caused anyone any permanent harm. The quick release lock on the extinguisher bracket was worn and the vibration on takeoff caused it to open releasing the extinguisher. This might be a good item to add to your personal preflight checklist.

NOMEX SAVE

Not all the info is in, but a helicopter pilot walked away from the remains of his UH-1F with relatively minor burns, although the aircraft was engulfed in flames. Another plus for the Nomex flight suit and gloves. Wear yours!

OPS TOPICS

GEAR UP (WHEN SAFELY AIRBORNE?)



The T-38 touched down slightly hot on a no-flap touch and go. The IP applied mil power on both engines and immediately raised the gear handle. The aircraft became airborne with a slightly lower pitch attitude than normal. This, combined with the increased drag from the gear doors as the gear cycled, caused the aircraft to settle back to the runway. The IP guessed something was wrong when he heard the inner gear doors scraping the runway so he selected max AB and increased the pitch attitude. This did not prevent the aircraft from settling further until the left stabilator and engine ejector covers contacted the runway. The IP completed the takeoff and after getting everything together made an uneventful landing. Quote from report "IP does not know why he raised gear prematurely."

AIRPORT ROTATING BEACONS

The following is a quote from an ALMAJCOM message. "The airport rotating beacon shall be turned off during periods when the control tower is closed unless local procedures require runway lights to remain on or the capability exists to immediately activate the runway lights upon pilot request."

WAKE TURBULENCE

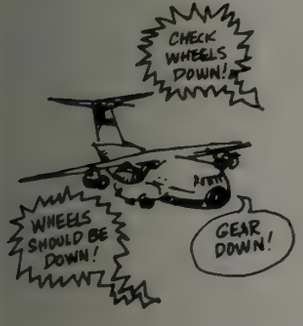


The T-38 was approximately 2 minutes behind a C-130 for landing--winds calm. After touchdown, the aircraft started drifting left. The IP was forced to use right rudder and right brake to recover. During the recovery, both tires blew as a result of the recovery problems associated with wake turbulence which, with no wind, was not dissipated soon enough.

ENERGY SHORTAGE?

A helicopter pilot had his flight cut short because of a flameout from fuel starvation. He knowingly departed the home drome with less than a full fuel load and an inoperative fuel gauge.

REPORT THE GEAR



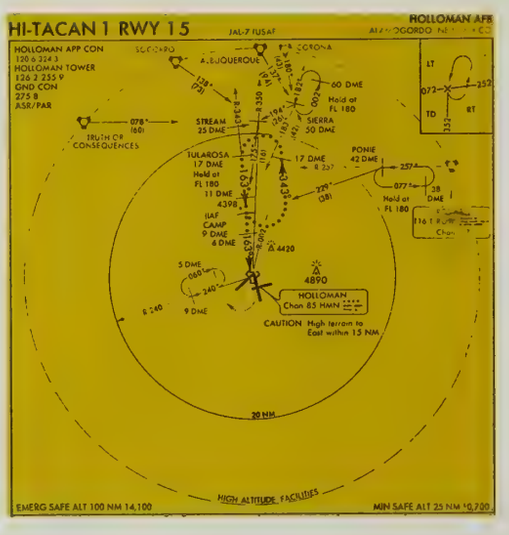
There is a USAF change to landing gear position reporting procedures that will appear in the next change to AFR 60-16. "All USAF Air Traffic Controllers shall remind the pilot to check gear down by stating 'check wheels down' when the aircraft reaches an appropriate position in the visual pattern, unless the pilot has previously reported wheels down. On all radar controlled or monitored approaches, the air traffic controller shall remind the pilot to check gear down by stating 'wheels should be down' prior to final descent. Pilots will report 'gear down' to the appropriate air traffic control unit or runway supervisory unit after completing the aircrew before landing checklist. The report 'gear down' must be made prior to crossing runway threshold...and before final approach alignment on a visual approach or before reaching three miles from the runway when making a straight-in approach. This report must be made for all approaches to an airport, civil or military."

THE FLIGHT EXAMINER'S DREAM

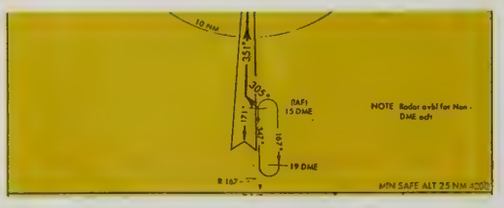
It must have been something I ate because I had this horrible dream. I dreamt I was laying out the most difficult approach to an airdrome that could possibly be devised. It would be the most complicated and taxing to fly because it would demand an extraordinary amount of one's attention. There wouldn't be anything illegal about it, and it would certainly meet TERPs criteria. My thought was to take some parts of existing approaches and combine them into one masterful, mind-blowing approach at a fictitious field. I would have all check flight examinees fly my approach so they would have greater appreciation for the fact that approach plates must be studied very carefully.

I worked fiendishly, searching through the letdown books for parts of approaches that were seemingly designed to make flying tricky and dangerous.

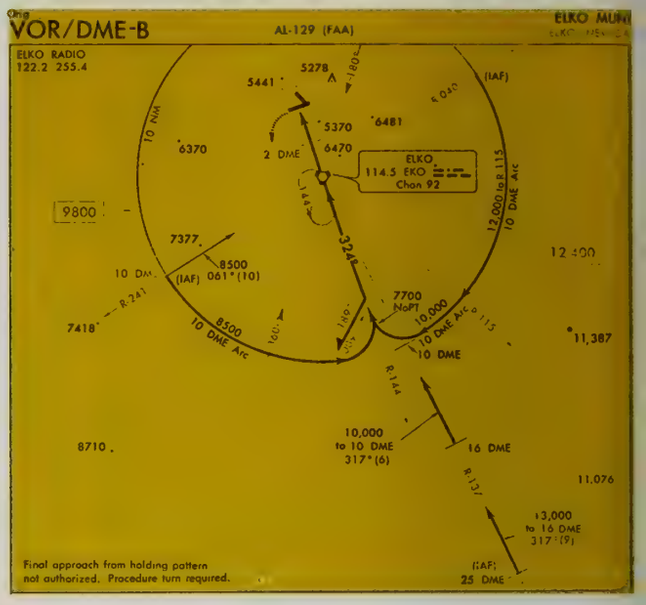
I thought I would use the feeder fixes from the HI-TACAN 1 RWY 15 approach to Holloman AFB. I could start the flight at Albuquerque with a clearance to Camp IAF.



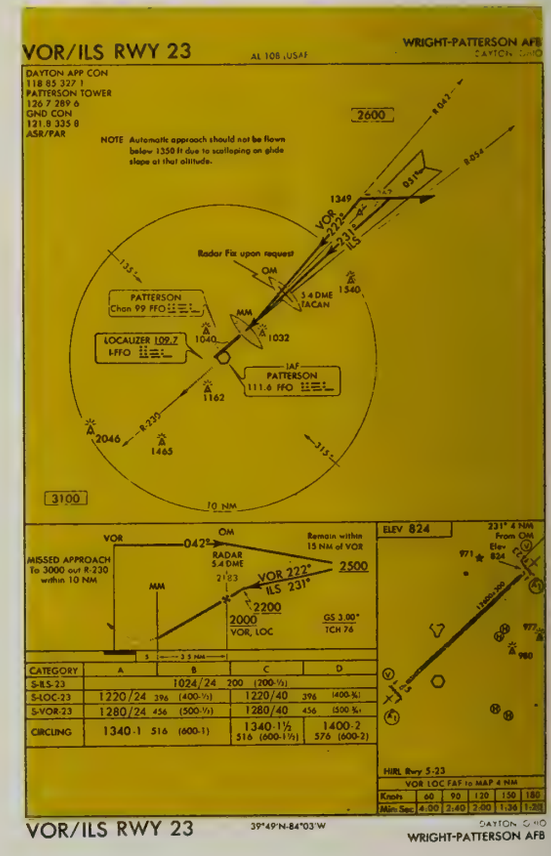
I liked the IAF holding pattern on the Webb AFB ILS RWY 35R approach plate because chances are pilots would forget that the inbound course is 351° and not 347°.



The same thing could happen if I used the VOR/DME-B approach to Elko Muni, Elko, Nevada. Approaching the 10 DME Arc from the IAF on the 137° radial, a pilot could forget that the approach course is 324° and not 317°.



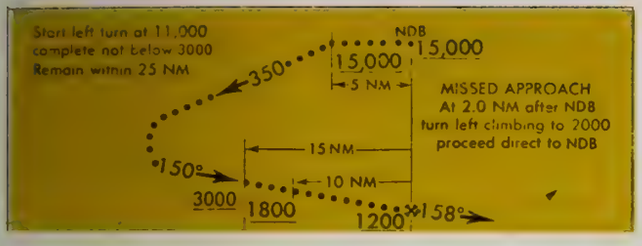
I could set up a pilot for a teardrop procedure turn situation using the VOR/ILS RWY 23 approach at Wright-Patterson AFB. I'd bet the examinee would be fooled into starting the teardrop at the VOR instead of at the OM, unless he would see the "042°" fly-off course on the profile view.



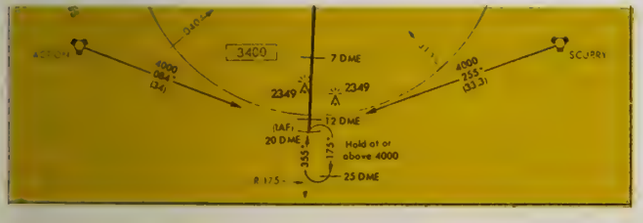
I wanted to include a tight 7NM DME Arc like the one at Suffolk County Airport, Westhampton Beach, New York in the TACAN RWY 6 approach.

And a DR leg over 15NM long like the one in the ILS RWY 30 approach to Hamilton AFB.

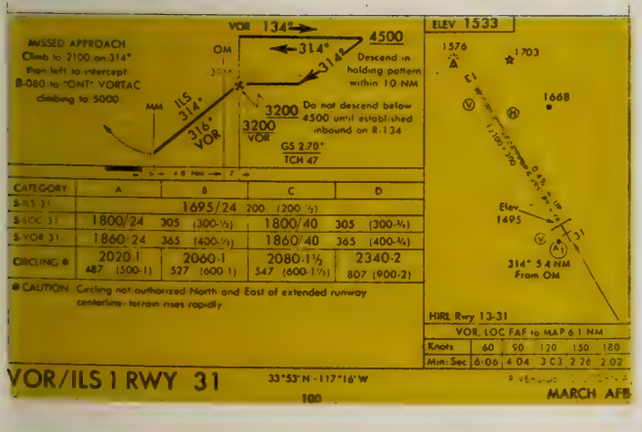
I wonder how pilots would fix themselves if I threw in some altitude restrictions like the ones in the HI-NDB (UHF)-A approach to Chase Field NAS at Beeville, Texas.



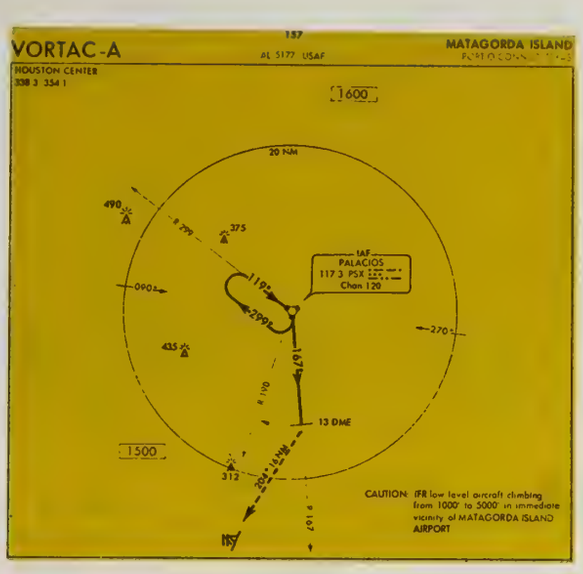
I could scare the Hell out of my examinees if I had them pop out from under the hood momentarily at night between the 12 and 7 DME fix on the TACAN RWY 35 approach to Dallas NAS (Hensley Field). At 2800 feet indicated, over and between the two towers that go up to 2349 feet MSL, they would learn to maintain altitude. If the altimeters work perfectly and we have the latest altimeter setting we will be 451 feet above the towers.



I might use a MAP timing problem like the one on the VOR/ILS 1 RWY 31 approach at March AFB. I'll bet most pilots will mistakenly hack the time passing the OM and use the airspeed/time chart on the plate.



I liked the 16NM VFR leg on the Matagorda Island VORTAC-A approach at Port O'Conner, Texas. I'll ask the pilots how they can tell if they have three miles visibility at the 13 DME fix. I'd break them out at that point and then put them back into the soup again about half way to the base on the VFR leg. Wish I could arrange for about a 40 knot crosswind from the Northwest! Maybe they would miss the island completely, even if they were VFR. I'm glad they didn't use a radial direct from Palacios to the field or I would never have had the idea.



Of course, there were also some other interesting final approach courses like the one on the HI-TACAN-A approach into Toledo Express, Toledo, Ohio. It's an 11 DME Arc.

After level off at the MDA I thought I'd crank in a small addition to the MDA like on the VOR RWY 4 approach to Schenectady County Airport, Schenectady, New York. It said, "Use Albany, New York, altimeter setting when control zone not effective and add 20 feet to all MDAs." That's a good check ride buster.

If I decided to use a DH instead of an MDA, I could have the localizer offset like on the HI-ILS 1 RWY 35 approach to Carswell AFB. That way I will be able to tell if the examinee peeks.

I picked a missed approach procedure like the one at Helena, Montana on the ILS RWY 26 approach. It read, "Climb straight ahead to 4250, climbing right turn to heading 018° to intercept R-333 HLN VORTAC. Climb northwest bound to 6300 within 13 NM then left climbing turn to 8000 direct to HLN VORTAC and hold."

I know there probably are good reasons for these approaches to be the way they are, and I'm certain Air Traffic Control Board members don't have bad dreams. But the approaches certainly are a flight examiner's dream. They violate a basic safety tenet which says that there is safety in simplicity. ★

FLIGHTLINE



LT COL CHARLES F. YOUNT
Directorate of Inspection

OBSTACLE COURSE

Pilots do not cause all aircraft taxi accidents. Maintenance/material factors often cause or contribute. I thought an analysis of recent taxi accidents would reveal when, where and how most of them occur; however, such is not the case. Taxiing aircraft have run into or over almost everything imaginable, for any number of reasons. No single cause factor stands out. About as many taxi accidents occur at home station as away from home. Neither daylight nor darkness seems to have an affect, nor does the presence of marshallers. No one thing is involved more often than others, except, of course, the poor airplane that happened to be designed with protruding wings.

Faced with a lack of trends, what can maintenance people do to prevent taxi accidents? The pilot is ultimately responsible for all taxi accidents, but there's a lot we can do besides making sure the hydraulic system, brakes and tires are in good repair.

While maintenance men aren't responsible for designing aircraft parking plans and taxiways to ensure adequate clearance, we see the plan in operation every day and can provide feedback to the civil engineers. If there are any hazardous areas, they should be reported. Maintenance projects as well as civil engineer construction jobs and equipment can either temporarily or permanently encroach upon the adequate clearance provided in the original parking plan. This is why parking plans should be periodically reviewed. Most bases have an airfield survey committee whose job it is to spot these violations to airfield criteria established in AFM 86-8. The committee tours the airfield on a regular basis, usually monthly.

Aircraft located on certain parking spots have a higher potential for being involved in a taxi accident. These spots are usually located at taxiway intersections, on the transient ramp or in areas that are seldom used. People who select aircraft parking spots should know which spots are more hazardous and avoid using them when possible.

Transient aircraft parking areas deserve special attention. The taxiway lines are usually designed for the largest aircraft that *normally* transit the base. There may not be sufficient clearance if a big transient cargo or bomber aircraft taxis in. This is why certain spots should be designated for the bigger than big and a taxi route to that spot should be thought about in advance.

Remember hearing about the tug driver who saw an aircraft approaching as he towed an engine and prop on a fighter base taxiway? He pulled off the taxiway and turned off his lights, leaving plenty of clearance for an F-4. Unfortunately the C-141 wing struck the propeller the tug driver was towing and the propeller blade tore open a fuel tank in the C-141 and the fuel was ignited by the cut wingtip wiring.

How about the aircraft that collided head on with a big yellow





Lack of attention, obstacles where aircraft can hit them caused costly mishaps shown above.

sweeper in broad daylight? It usually takes two cases of tunnel vision for that to happen. We should keep our heads on a swivel because taxiing aircraft have the right of way. Driving on the flightline is dangerous business, that's why those of us who must drive there have "FLA," flightline authorized, stamped on our US Government Motor Vehicle Operator's Identification Card. We've been briefed on the special hazards and the ramp speed limits, 15 mph (10 mph for special purpose vehicles), except near aircraft when the speed limit drops to 5 mph. Private vehicle operation on the flightline must be kept to a minimum.

While we are staying out of the way of taxiing aircraft there is something we can do to keep things moving—be a wing walker. Aircraft may not taxi with less than 10 feet of wingtip clearance. At 10 to 25 feet of wingtip clearance the pilot must have a wing walker. (See AFR 60-11 for exception.) That could be you if you're on the scene. This means you should know the basic signals for the control of aircraft on the ground. If you see an aircraft about to taxi near something don't just keep on trucking, stop and do some wing walking.

Every piece of AGE on the flightline is a potential accident just waiting to happen. If it must be there for efficient maintenance, fine; but if it doesn't, have it removed to the AGE staging area. How many times have you seen AGE left on the flightline for long periods, even days, before it was removed. If ground equipment must be prepositioned before an aircraft arrives, place it so it doesn't get hit in case the aircraft brakes fail. For the TA guys, it's easy to develop habits or routines to position AGE for small aircraft and then leave insufficient clearance for a large transient aircraft.

Things on the flightline must be visible. This means keeping AGE painted and the reflective material in good repair. In the dark, how visible is a small AGE unit that is dirty and has some of the reflective material missing? Or a unit that has been camouflage painted?

Everyone can help reduce taxi accidents if he stays alert and reports potential taxi hazards. Remember, it takes two things to collide. If one can be removed—no collision. ★







There's no excuse for scenes such as that in top photo. Will wingtip clear van in lower photo?

if you're the pilot who has been following the marshaller into a taxiing accident, just remember—for you there's . . .

NO EXCUSE

MAJOR ROBERT H. IKELMAN
Directorate of Aerospace Safety

The aircraft are returning from the first mission of the day, as they have done so many times before, to the parking spots nestled between the revetments and buildings. The marshaller is positioned by the maintenance hangar and the copilot is monitoring the right wing tip for the 180° turn to the parking spot. As the wing approaches the hangar the marshaller is still motioning with great exuberance and there is not a word from the copilot. Just before the wing hits the sheet metal of the building, the marshaller signals an immediate stop by covering his head with his crossed arms.

Luckily only the right wingtip navigation light was damaged. There is no excuse for this type of incident; there is a cause—complacency. Complacency fostered by the feeling that the mission is nearly over and familiarity with the taxi route. The mission isn't completed until the aircraft is in the chocks and the engines are shut down. Folding up the charts and repacking the let-down books can wait.

Navigation on the ground has always been a problem for airplane drivers, and it is increasing with larger aircraft being parked on the same old congested ramp spaces. The obvious conclusion is that the large transport/bomber aircraft would have more taxi mishaps than



the fighter/trainer aircraft. On the contrary, however, the figures show that the fighters are running neck and neck with the transports for the number of mishaps.

The Air Force has experienced 133 mishaps in the past five years in which the aircraft were unintentionally taxied over or into various obstacles such as buildings and other aircraft, poles, trees, light carts, power carts, fire extinguishers and an assortment of vehicles.

In 1974 there were one major aircraft accident and 25 incidents attributed to aircraft taxi mishaps with the transport/bomber and the fighter/trainer ending in a 13 to 13 tie. These mishaps cost the Air Force $119,379 in aircraft damage, not to mention damage to ground equipment, buildings and vehicles.

The sad aspect of these accidents is that many of them happened in open areas where obstructions were present on only one side of the taxi route. A classic example of this occurred when a C-130 Herky Bird taxied into a concrete light pole two feet off the left edge of the ramp area. The ramp was virtually clear to the right, but the pilot was distracted in the cockpit while taxiing and allowed the aircraft to drift left. His correction to the right was insufficient and his decision to stop too late to prevent the collision. That bit of distraction cost $25,756.

Several accidents last year involved deviations from known taxi routes or lines. A C-130 pilot maneuvered his aircraft out of the taxiway, while positioning for runup, and the right wing struck some trees adjacent to the ramp, resulting in damage to the leading edge and aileron.

During taxi-in, a follow-me moved to the left of the taxi line, then turned right into the final parking area. A C-130 followed right behind. As the crew's attention was directed to the right, the left wing struck a wooden light pole about 8 feet in from the wingtip.

Taxiing into an already congested ramp, the pilot of a C-141 maneuvered left of the taxi line to complete a hard 225° turn into the spot. As he started the right turn, with the right MLG 27½ feet left of the centerline, the left wing struck a light pole situated 105 feet from the taxi line.

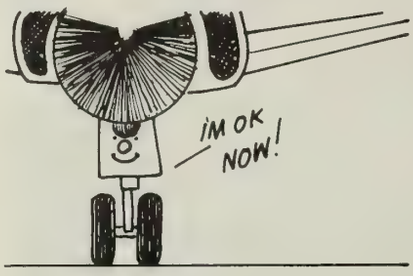
The biggest problem with the fighter types is that they have a liking for buildings or power carts. Six F-4s and one F-106 struck hangar doors with their wingtips and pitot booms as they taxied out of or into the shelters. Four other F-4s and a T-38 struck power carts as they taxied into and from parking spots.

Another problem on the ramp is the big red fire extinguishers used for fire protection during starts. A T-29 and a C-130 crunched a couple of fire bottles during taxi for takeoff after refueling on a stopover flight plan. In an effort to expedite that departure the T-29 crew started engines and began taxiing without transient alert assistance. The C-130 struck a fire bottle that had been placed directly in front of the nose gear. The loadmaster did not observe the fire bottle during engine start.

No matter what factors are involved leading to the taxi mishap, the pilot is always ultimately responsible. He is responsible to maintain the wingtip clearances as specificed in AFR 60-11; "Aircraft will not be taxied at any time within 10 ft of an obstruction. Aircraft being taxied within 25 feet of an obstruction will have a taxi signalman at each wing tip." How does a pilot judge the 10 or 25 foot distance? That is about the distance at which binocular eyes become of little value. There are clues, like the distance between the shadows formed by the wingtip and the obstruction, or the relative size of the object being passed. But these are all approximations; so if it is close, don't taxi. Stop and make sure. There is "No Excuse!" ★

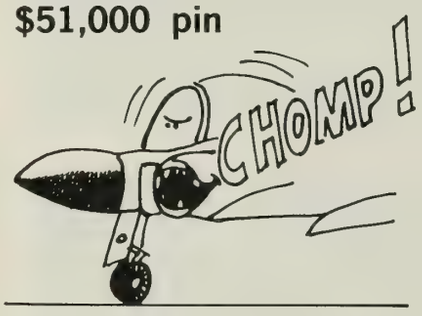
TECH TOPICS

lack of lubrication



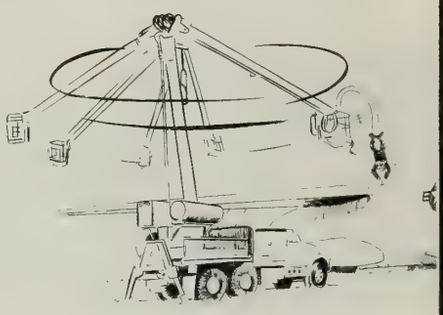
There have been two cases within the past two months of aircraft having a gear indicator malfunction. In both cases the corrective action was "lubricated and ops checked good." On one aircraft the oil lubrication hole was covered with paint and dirt. Due to the lack of lubrication, the locking cam was unable to swivel, making a safe indication of down and locked impossible. The gear handle linkage on the second aircraft was lubricated, which quickly solved the problem.

the case of the $51,000 pin



Who would ever think that a wing tank pin costs so much? Just after the F-4 started to taxi, the ground crew noticed that the wing tank pins were still installed in the pylon and signaled the pilot to stop. The chief was removing the left pin and an additional mechanic was removing the right pin. The mechanic on the right wing threw the pin under the aircraft to the chief on the left wing but the pin never made it to the chief. Instead, the left engine ate it!

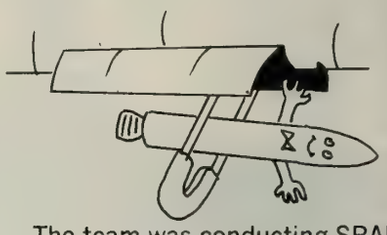
improving the equipment



Now that spring is here and the equipment used for snow removal won't be needed, it is a good time to start checking it and making any repairs necessary so it will be ready for next winter's use. The M-1 deicer truck is of special interest because of its complexity and the possible consequences if it is not properly maintained. A case in point occurred when an airman was blowing snow from an aircraft from the aerial work platform of a deicer truck. Four bolts backed out from a mounting bracket, allowing a gear reduction unit to disengage from the rotating base. That resulted in a freely rotating aerial platform, with the air blast from the air nozzle providing a propulsion force that caused uncontrollable rotation. The thing was spinning like a top, with the airman 25 feet above the ground. This continued for several minutes, until the airman was thrown from the platform.

The shortage of funds and parts makes preventive maintenance more important than ever. Now is the time to order parts and bring that special purpose gear up to speed—not when the snow flies next fall.

pinned by dummy



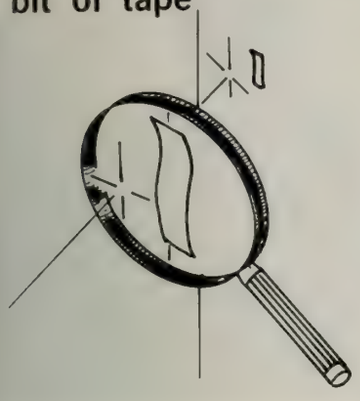
The team was conducting SRAM upload training on a B-52, using a concrete filled dummy missile. When the MHU-83AE bomblift truck driver reached for the TO lying on the hood, he inadvertently caught the gearshift lever with his sleeve and shifted into reverse. A loading technician was pinned between the dummy missile and the bomb bay door. Fortunately he wasn't seriously injured.

A little more careful next time, okay?

punctured fuel tank

Preflight inspection was complete and everything looked good through engine start. Just before the F-4 taxied, the PC-1 hydraulic system pressure was discovered to be below the normal operating limit. It was serviced. Then during removal of the servicing cart, fuel was detected spraying from the drop tank. After the pilot shut down the engines, an investigation revealed that the mechanic doing the servicing was watching the flap area while removing the servicing cart and struck the drop tank, puncturing it. An incident of this nature means loss of a training mission, and man-hours to remove, replace and repair the damage. It seems the mechanic is always pressed for time to do the job right the first time, but manages to find time to redo the job and/or additional work—as in this case.

a bit of tape



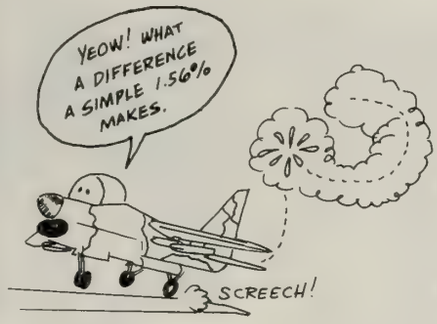
After a C-141 lost its crash position indicator (CPI), the CPI impact switch in the right wing was found to have been wrapped with metallic tape during maintenance. The tape caused the switch to short and deploy the CPI. Reason for the tape was to protect the switch during fuel leak tests. Unfortunately, they were out of plastic tape, so used metallic and forgot to remove it during cleanup.

no chute, no hook

"No chute" was the cry from the F-4 pilot. The flight was normal through touchdown, but when the pilot pulled the deployment handle the drag chute fell out on the runway. The chute departed because the metal shackle was not properly installed in the drag chute retaining mechanism, and the crew chief failed to recognize the improper positioning of the jaws during the drag chute installation inspection.

Loss of the drag chute preceded failure of the hook to lower—and on a wet runway with a low RCR. The aircraft was finally stopped by the MA-1A barrier. The hook failed because of a flat spot on the roller and a small dent in the shoe assembly.

engine trimming



During an A-7 training mission, the pilot returned to the home base area for multiple patterns. After several low approaches, as the pilot started his go-around, the aircraft suffered a power loss. At about 50 feet AGL with the throttle set at full military and the engine just reaching military, the pilot felt a large power loss and landed. This was the first flight after release after an FCF for engine change. Maintenance made a power loss check, and the engine was found to be out of trim. After researching previous records, it was discovered that the trim box used to trim this engine prior to the FCF was defective. The engine trim card read 93.5 percent as opposed to the data plate speed on the engine of 95.06 percent. Some engine parameters are trimmed according to data plate speed. A helpful hint for engine trims: If the trim box indications differ more than a few degrees (see the TO) centigrade from the cockpit readings, the trim box should be tested to check its accuracy. Check the engine data plate against the trim card data speed to confirm they agree.

a fire replaced the torque wrench

Fire damage, discovered during postflight inspection of a B-52 engine, was caused by improper torque. The distributor mount studs on the pressurization and dump valve were only finger tight and worked loose, allowing fuel to spray on the hot engine and ignite.

crossed threads

Nrs 1 and 2 engine driven hydraulic pumps on a KC-135 disintegrated.

Nrs 1 and 5 tires were blown on landing.

Buckles and cracks in the left main landing gear door.

Why? The case drain fitting on the nr 2 hydraulic pump ruptured.

Why? The drain plug had been cross-threaded during assembly.

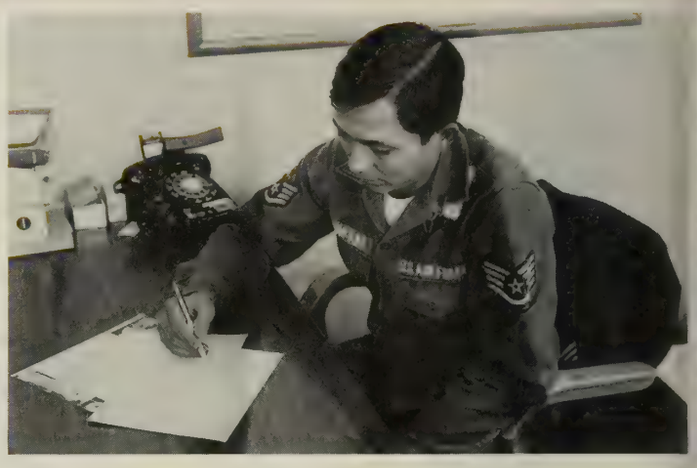
Why?

proper guidance needed

During a C-141 departure preparation, with two freight loaders assisting, the aircraft's APU was started and the scanner removed the chock from behind the left main landing gear and placed it behind the nose gear. Since the external power unit had been removed and the scanner had removed the chock, the freight personnel thought the before-starting-engine checklist was in progress and they removed the three remaining chocks. With the aircraft parking brake not set and the flight crew not in position, the aircraft rolled forward 10 feet and struck a portable fire extinguisher. ★

HOW TO MAKE changes

MAJOR BRIAN C. BERNET, CF
Directorate of Aerospace Safety



During recent visits to the field, I have heard comments that something on the aircraft could be changed to make the pilot's task easier. For example, some switch or light is poorly located or is unsuitable for night operations.

When I ask which form should be used to officially suggest a modification to the aircraft, I am usually given a choice. So, for those of us who are not sure which form to use, here is a brief review.

AFTO FORM 22. Use this for changes to any aircraft technical order except the ones in the flight manual series. Quality Control (QC) personnel maintain a suspense log for this form, reference TO 00-5-1, and will help you submit it. Maintenance personnel will review and judge your suggestion. If you have an emergency or urgent safety suggestion, they'll forward it by message.

AF FORM 847. For amending flight manuals (TO -1, 1-1C-1, -5, -6CF, -9, -34). Your unit stan/eval people will maintain the suspense log, reference AFR 60-9, and help with your suggestion. The operations staff reviews this form. Emergency and urgent safety proposals will be submitted to higher headquarters by message.

AF FORM 1000. Can be used for suggesting changes which are made for convenience, or will reduce pilot workload. An example would be minor changes in position of cockpit lights and switches. The base suggestion committee will process your suggestion. Changes which have a safety justification should also be submitted on a hazard report or materiel deficiency report.

HAZARD REPORT, AF FORM 457. Use this form for any hazard that has a safety justification; However, use a more appropriate form if you can (refer to AFR 127-6). AF Form 457 applies to things from poor cockpit lighting to inadequate airfield arrestor gear. This report and AF Form 1000 have the advantage that you personally will receive a written reply to your suggestion. If you use this form for reporting the hazardous quality of equipment, the unsatisfactory condition may have to be reported on a different form by your unit to ensure prompt Air Force-wide corrective action. The unit safety office will help with your report and maintain the suspense.

UNSATISFACTORY MATERIEL REPORTS. This is the best method for reporting any materiel deficiency and for obtaining changes such as those we first mentioned, changes in form, fit or function of equipment. Your unit QC personnel will help you draft the report in the accepted manner. AFLC will allot a priority to each proposal they receive. (Reference TO 00-35D-54 for specific information on submitting UMRs.) The UMR can be used to obtain changes in ANY equipment whether it be airplanes or knives and forks. Many people have the mistaken idea that a UMR can only be submitted following an accident or incident. The possibility that the unsatisfactory condition could be a hazard is sufficient justification. This includes annoyances and irritations which unnecessarily distract or tire aircrews or cause unnecessary motions in the performance of their duties.

The UMR is a far more efficient and effective way of obtaining changes to equipment than the hazard report or AF Form 1000. It goes directly to the proper people in AFLC who are where the action is when it comes to approving changes. If in a proposal you can show that money can be saved, do so. It can only improve the chances your idea will be accepted. Be sure your case is well documented. Your chief of maintenance must approve UMRs before they leave the base. This is the first test of the validity of your suggestion.

When the UMR gets into AFLC channels, your unit will be notified of what action the ALC will take. The name and telephone number

f the technician who is working
n your suggestion will also be
rovided. The forthcoming revision
TO-00-35D-54 will specify
ow soon after receipt of your UMR
our unit will get a response.
your aircraft is operated by other
ommands, then all users will have
agree to a modification before a
ange can be made to any aircraft.
your model alone is to be
anged, then the reason must be
ddressed.

People sometimes get the im-
ression that nothing can be
anged. Individuals have com-
ented—"The system is too big"—
It could take five years to get it
anged"—"The airplane may be
ut of service in two years."

A close look at the system will
ow that generally it works well if
e problem is properly identified
nd the proposed solution is ap-
ropriate. If a reply to your sug-
estion says, "This modification is
ot justified, no action is war-
anted," it means that the known
acts did not support it. Many good
deas would have died at this
oint if it were not for the per-
stence of the dedicated individuals
ho resubmitted their suggestions
ith a stronger case. If you consider
modification reported by another
nit to be valid, there is nothing to
op you from submitting a report
ourself. Your justification and
olution to the problem may add a
ital impetus to the original idea.

A review of AFR 127-4, AFR
27-6 and TO 00-35D-54 is
resently under way. So, until the
egs change, I hope this guide will
ssist in the realization of some of
hose good ideas.

Remember, your continued effort
nd suggestions are necessary if we
re to avoid flying aircraft year
fter year with small annoyances
nd inconveniences which hinder a
ilot's performance and could lead
o a mishap. ★

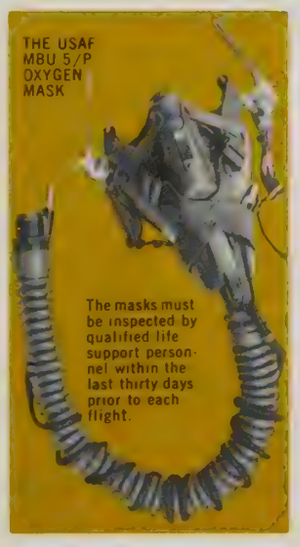
Advertisement For USAF Life Support System

QUESTION: Which biological need is so acute it must be satisfied during high altitude flights of short duration?



ANSWER: D. OXYGEN.

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MISSILE TOPICS



STOP AND THINK

When a missile mishap occurs, you are not out of the woods until all is safe. Recovery actions taken without positive assurance that they are right for the situation can leave you in a more precarious position than before. During a recent reentry vehicle (RV) mating operation, the reentry vehicle/spacer assembly was inadvertently and abruptly lowered, hitting the penetration aid spacer. The technician, under stress and reacting to the event, raised the assembly. This action could have proved disastrous, but fortunately we lucked out again. The most reasonable (and safest) assumption at the time was that the hoist had failed. Under those circumstances, raising the RV exposed it to a second and greater fall. The point is that "no action" is sometimes best. SACR 355-3, Missile (ICBM) Potential Hazard System, contains sensible, practical guidance for meeting those unusual situations which exceed technical data, personnel, or equipment limitations.



HALFWAY SMART

It is not enough to make a missile system foolproof; one seldom meets fools in the missile business. One does, however, meet smart operators who may be inclined to shortcut required steps which they think are unnecessary. Such shortcutting is foolhardy and the primrose path to a missile accident. . . .

THE PROBLEM WITH HAZARD REPORTING

Once a hazard is identified, the fix, in most cases, can be quickly and easily implemented. Correcting the hazard is usually less of a problem than convincing people that hazards should be reported. That's why we have AFR 127-6, The USAF Hazard Reporting System. It provides a simple and effective method of bringing an unsafe condition to the attention of someone who can fix it. Correcting hazards is easy—getting people to report them is a little more difficult.

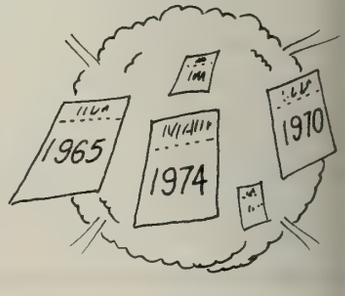


LEST WE FORGET

- Ten years ago, the voltage regulator on the motor generator in a Minuteman launch facility burned up because output leads on radio frequency interference filters had been connected in reverse.

- Five years ago, a missile technician caused a short in a Titan II complex, which created an overvoltage. The result was a burned out dehumidifier motor and control transformer in the missile air conditioner.

- One year ago, a Minuteman missile was destroyed in flight because of a guidance malfunction. ★



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Well Done Award

Presented for

utstanding airmanship

and professional

performance during

hazardous situation

and for a

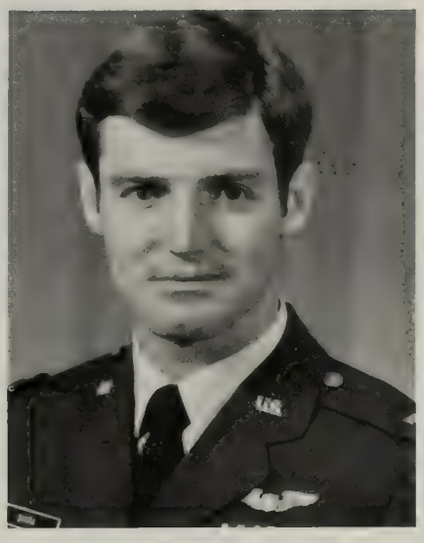
gnificant contribution

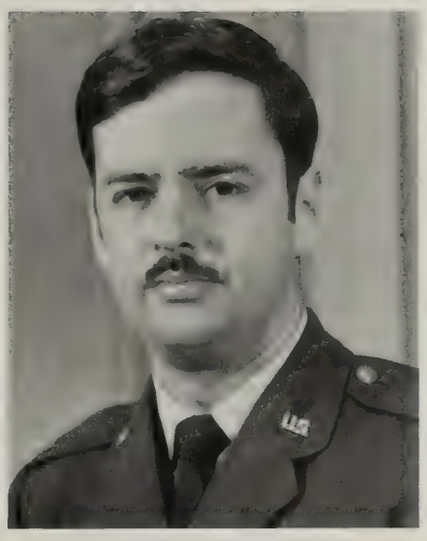
to the

ited States Air Force

Accident Prevention

Program.





Captain
MICHAEL J. SHIRA

Second Lieutenant
DAVID L. COLEY

354th Tactical Fighter Squadron (TAC)
Davis-Monthan AFB, Arizona

On 13 June 1974, Lt Coley, an A-7D upgrade trainee, and his instructor pilot, Capt Shira, were flying a two ship air-to-air mission approximately 100 nautical miles east of Davis-Monthan AFB. During a moderate turn in tactical formation at FL240, the engine in Lt Coley's aircraft began a series of rapid compressor stalls. Retarding the throttle to idle, he put the aircraft into a dive. As his airspeed increased the stalls cleared. When Lt Coley re-advanced the throttle, the engine again began to compressor stall. He again retarded the throttle and the stalls cleared. Meanwhile, Capt Shira established the flight on a maximum range descent back to Davis-Monthan AFB.

Ten miles out on final, Lt Coley put gear and flaps down and advanced power, but the RPM would not go above 80 percent, even though the fuel flow increased and the engine nearly overtemped. Lt Coley immediately brought the gear back up and retarded the throttle back to its former setting.

Knowing Lt Coley's aircraft had insufficient thrust available for a normal approach and landing, Capt Shira analyzed the altitude, airspeed, and RPM to determine when the gear could again be extended. Capt Shira instructed Lt Coley to lower the gear at three miles on final, and a successful landing was accomplished. When Lt Coley retarded the throttle to idle on touchdown, however, the RPM unwound to 40 percent and the engine seized. A ten foot streak of fire was seen coming from the tailpipe. Lt Coley stopped the aircraft on the runway and egressed, and the fire was extinguished with no damage to the airframe. Extensive damage throughout the turbine section was found during engine teardown.

The exceptional skill, judgment, and teamwork displayed by Capt Shira and Lt Coley prevented the loss of a valuable aircraft. WELL DONE! ★

Gear is issued . . .
Signs are up . . .
Guards are installed . . .
THE REST IS UP TO YOU!



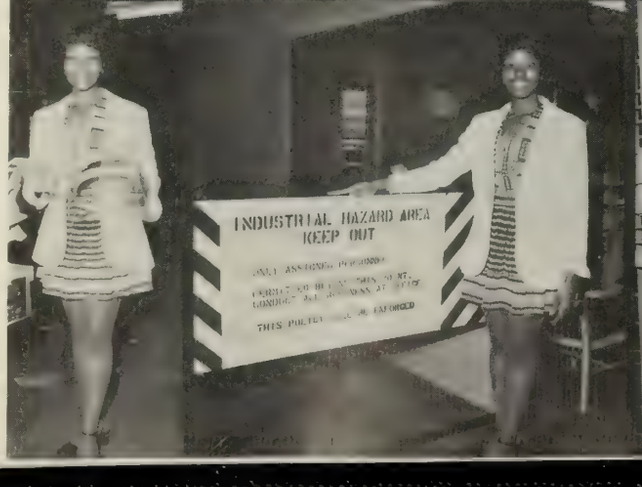
Sharon Thomas works part time in AFISC and attends college, where she is preparing for a law career. On-the-job safety is her prime concern in scenes on this page.













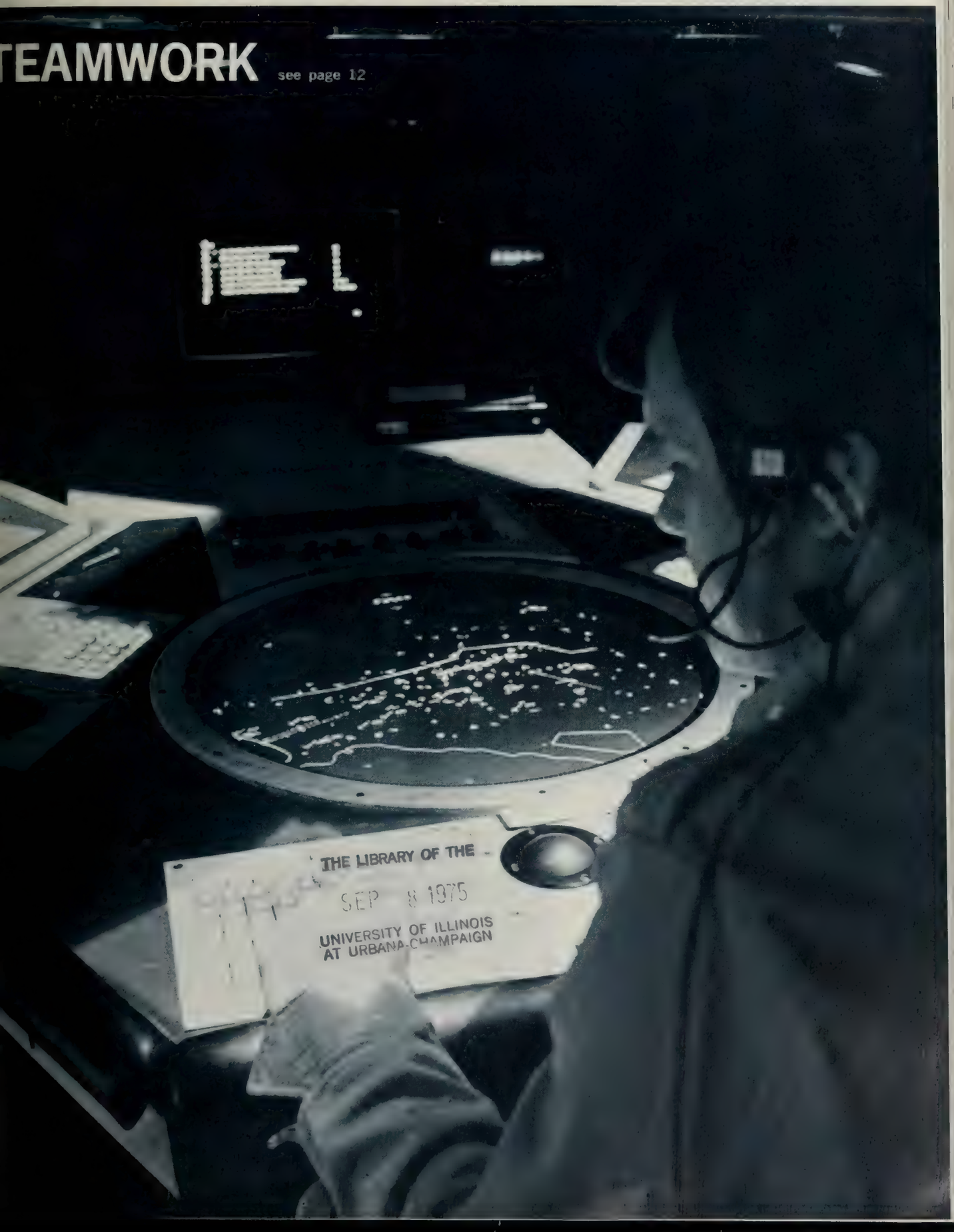


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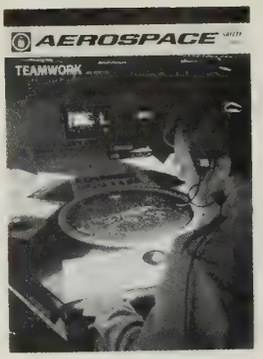
TEAMWORK

see page 12



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UNITED STATES AIR FORCE JUNE 1975

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JUNE 1975 AFRP 127-2 VOLUME 31 NUMBER 6

MARK HUNTER TALKS TO THE FLIGHT SURGEON

DANER R. REIDER, MAJOR, USAF, MC
Directorate of Aerospace Safety





The following article is based on conversations with four flight surgeons from different commands: Major Clark, Charleston AFB, SC; Captain Romeiser, Plattsburg AFB, NY; Captain Naylor, Williams AFB, AZ; Captain Allred, George AFB, CA. The flight surgeon in the photos is Captain Schultz, Norton AFB, CA. Our thanks to the docs for taking time from their busy schedules to share some of their thoughts with our readers.—ed.

Doc, I am Capt Hunter from the Safety Center. Several of us here were talking this morning about the relationship between the flight surgeon and the crewmembers at his base. If you have a few minutes I'd like to ask you about aircrew health and safety as seen from your viewpoint.

A Well Mark, I'll try my best to help you. All of us here enjoy working with aircrews and welcome any chance to increase our rapport with them.

MH That's my first question, how do you gain and maintain rapport with flying personnel?

A I try to be available to meet their needs. For example, on some bases we visit the flightline for sick call, and we try to make it easy for them to see us at other times of the day. Of course we fly with them as much as possible; but the fuel crunch and the doctor shortage here at the hospital have made flying more difficult. Nevertheless, I think the crews appreciate seeing us come to those early morning briefings and encountering some of the operational problems they face.

We hear complaints about some of the irritants that add to the crew duty day, cause frustration or divert the pilot's attention. Other times we hear about some life support equipment problem or complaint about the hospital. Generally, we try to research the problem and get back to the guy who asked the question.

Another thing that I really believe is worthwhile is seeing the crewmembers' dependents. By doing this, we can keep a close watch on the health of the wives and children. As you know, the health and welfare of the flier are affected by the medical status of his dependents. Finally, we routinely present medical topics at the flight safety meetings in a language they understand. Last month I talked about rapid decompression at high altitude. Key points stressed during that talk were: (1) availability of O_2 equipment, (2) importance of knowing how to use it, (3) the minimal time available because of the very short periods of useful consciousness, and (4) the criticality of crew discipline and coordination in the event passengers are on board.

MARK HUNTER TALKS TO THE FLIGHT SURGEON continued

MH How do you know what the fliers want to hear about at the safety meetings?

A I try to tailor the subject to season of the year, the geographical location of the base, or I discuss a current interest item in life support or public health. If I were a MAC flight surgeon, I would talk about eating places, drinking water and infectious diseases at the overseas bases and what precautions to take. At a TAC base, I would stress an adequate fluid intake to prevent dehydration. Disorientation and physical conditioning are also good subjects, because most of their flying is done in high performance aircraft. In ATC, the above topics would apply, as well as hypoxia and hyperventilation. Many crew members want to talk about private medical matters which we can resolve or, at least, for which give proper guidance.

MH What types of illnesses do you see most often during sick call?

A As a physician trained to diagnose and treat disease, it is very challenging and difficult to be a flight surgeon because crewmembers are so healthy. We are dealing with a young, carefully selected group of men who don't often get sick! They get the illnesses that healthy people get, mostly colds, minor nonspecific diarrhea and athletic injuries. The only complaint I have is that they don't want to be grounded, so they wait longer than they should before they finally come to see me. I'm constantly fighting the battle of self-medication and am in competition with drugstore medications that can very definitely affect fliers in an adverse way.

Almost everyone has heard about or seen the commercials about the many cold remedies available today. These drugs can cause drowsiness and lightheadedness. Some of the anti-diarrhea medications can even affect depth perception—an interesting and very dangerous side effect if one is attempting a tanker hook-up or flaring for landing.

All the flight surgeons discuss these things at the safety meetings, at parties, when flying with crewmembers, and when talking to their dependents. Unfortunately some of the crewmembers don't appreciate the dangers of self-medication and the importance of early diagnosis.

MH You mean people don't come in right away when they have a problem?

A Yes, they don't realize that the flight surgeon's job is to keep his people fit to fly. The minor cold is just that, when the flier is grounded for a few days and receives proper care. It is true that his commander cannot use him for flying for those 3-4 days; but that is far better than flying with a cold, breaking an eardrum, and then being grounded for 6-8 weeks while the ear heals or an eardrum repair is necessary. It is so much easier to shake a medical problem if it's treated in the early stages. We want to keep him flying, just as much as his squadron commander. We do **NOT** have as our objective the grounding of crewmembers.

MH What things have you discovered during flight physicals?

A The annual physicals are usually routine with only an occasional high blood pressure, mild high frequency hearing loss, and more infrequently, an abnormal EKG in the older crewmembers turning up. Last month, one of the flight surgeons noted an elevated blood pressure in one of our navigators. We took readings on him for five days, did some lab X ray tests, and started treatment. Yesterday, we submitted his case for waiver because his pressure is now under control. Without that annual physical, he might never have known about his problem until waiver would have been impossible; and he would have been permanently grounded.

MH What about jogging and aerobics testing related to aircrew health?

A Well, I guess I should start by saying it takes different strokes for different folks. I approve of and recommend any conditioning program providing that it is a graduated one and is one that appeals to the individual. Sure, jogging is easy because no special equipment is needed. However, tennis, swimming, handball, squash and bicycling can be just as good and can be effective. The key point to remember is that conditioning takes time and cannot be accomplished in one weekend. If that is attempted, the risk of a premature heart attack or another problem is very high. Recently, a friend of mine who is a flight surgeon at another base told me a very interesting and tragic story. A 31-year-old pilot, who exercised regularly, played an excessively vigorous game of basketball and became overly fatigued. When he reached home, he complained of chest pain and collapsed. His wife called the hospital, but efforts to save him at home and at the hospital were futile. The cause of death was a heart attack.

MH We've been hearing a lot about something called self-imposed stress. What is that all about?

A Self-imposed stress refers to those things we do to ourselves that are potentially dangerous to our health. Specifically, I think of smoking, abuse of alcohol, use of illicit or illegal drugs, and misuse of crew rest time. It is a known fact that smoking causes lung cancer and emphysema, so





Flight surgeons fly with the aircrews as much as possible, listen to their problems and complaints, try to answer their questions.

ıe use of tobacco is definitely azardous.

In addition, smoking raises the ood carbon monoxide level hich means the oxygen-carrying ility of the blood is decreased. fact, the effect is such that the noker is living in conditions quivalent to 5000 feet elevation hen he is actually standing at ea level. In other words, smokers re in a mild state of hypoxia all ıe time. The alcohol and drug roblems deserve special mention. here is no doubt that alcohol is ur number one drug problem— ot heroin or speed or barbs as one would believe from reading and listening to the media.

Alcohol is fairly cheap, legal, and is an active adjunct to every social function, either happy or sad. It depresses the nervous system, impairs judgment, decreases the speed of reflexes, and can cause irreversible damage to the liver. If everyone practiced moderation in drinking, nationwide, we could probably save 20 to 25,000 lives per year in automobile accidents. The obvious danger to fliers is apparent; and fortunately, to date, alcohol abuse has been documented as an insignificant factor in Air Force accident history.

The problem of crew rest has always been an elusive one to solve. As long as the Air Force maintains a worldwide posture, there will be crewmembers who face the difficulty of adjusting to many time zone changes on a regular basis. Overseas deployments during training exercises and cargo personnel movements are, and probably will be, the norm for many years. Everyone has a built-in clock that allows him to function at his best after adequate rest. The clock usually tells us that 6-8 hours of sleep is adequate. The problem is how to get adequate rest after being displaced by 6, 8, or even 10 time zones in a very short time. Probably the best advice is to try to keep your biological clock set to the new time zone if you plan to be there for a long period, or to your home base time zone if you are returning within a few days.

Regardless of how difficult it is, the crewmembers should keep 12 hours before a flight open for rest and sleep. Last-minute sightseeing, shopping, or bar-hopping is foolish and could spell disaster during the upcoming flight, when fatigue overcomes the flier during the last critical phases of descent, approach, and landing in bad weather at an alternate base which is not very familiar to the crew. There is a good Air Force film on Self-Imposed Stress which I would recommend to you for a safety meeting.

MH Doc, you've really covered a lot of ground in this short conversation and have given us a lot of food for thought. I want to thank you for your time and effort in giving us your views. I'll see you at the safety meeting on Friday. ★

water sports



They had started early for the lake for their first swim of the season. After hamburgers and Cokes at a nearby drive-in, they drove to the parking lot and loafed around the beach for a while, getting used to the chill of the water by dipping their feet into the lake. Finally the airman decided to brave the water and he swam around for awhile near the shore then started for a raft anchored some 30 yards out in the lake. After a few minutes the sergeant heard his friend yell for help and looked up just in time to see him go under about 10 yards from the raft.

The sergeant dashed into the water and swam as rapidly as he coul to the spot where he had last see his friend but he could not find hin After a fruitless search, he calle for help and the airman's boc was finally found by a volunte searcher.

It was early spring and the wat was still quite cold—60° F. Swin ming in water below 70° F. caus the body to consume a great deal energy just to keep warm. In th case the airman became tired fro swimming in the cold water, pa icked and drowned.

Unfortunately this scene wi variations occurred 36 times la year. As of this writing, April 1

even Air Force men have drowned his year while engaging in some vater sport — swimming, fishing, oating, skin and scuba diving.

The ocean surf can be extremely langerous for the unaware. One airnan was taking photographs when e was washed from the rock he was n by a huge wave. Another was wept from the rock from which he vas fishing. Both men drowned. A cuba diver was climbing out on to ome rocks when a wave slammed im against the rock, stunning him nd sweeping him into the water.

Some of these tragic events just on't make any sense at all. One nan was obviously drunk after conuming half a fifth of rum and some eer. He was having great fun—ntil he drowned.

Another man was picnicking with iends when he decided to strip own to his jeans and go for a swim the lake. The water temperature as 50 degrees. He got cramps and rowned.

OATING

Two men rented a sailboat and t off across a large lake. Neither as an experienced sailor. Near the r side, when they turned 90 derees to the wind, the boat capzed. The water there was about feet deep. When they got the boat ghted one man got aboard but it ok him 20 minutes to turn the oat, which was heading back out to the lake. Missing his friend, he ecided he had walked back along e shore. Later the man's body as found near where he had last been seen. Although the water was generally shallow, there were deep holes with sudden drop-offs. Apparently he fell into one of those holes, went under and drowned.

A SSgt made a fatal mistake when he exceeded his knowledge and skill in boating. Only a few days after buying a 16' outboard with a 75 hp engine, he had the steering system modified and a new console with an ice chest installed. The boat had a pressure operated stop prop ignition system. Normally the switch, which would turn off the engine when pressure on it is removed, is located on the floor where the driver can keep his foot on it or in the seat so he sits on it. Then if the operator should be thrown from the boat, the engine would stop. However, the sergeant installed the pressure switch under the ice chest which made it useless as a safety device.

Apparently the sergeant, alone in the boat, was trying out his new steering system by making hard turns at high speed. He was thrown from the boat. A witness saw him treading water and the boat come around and strike him.

Every year boating accidents take some lives. The SSgt in the preceding paragraphs was not alone — others died in boating accidents last year. In nearly every case the occupants were violating one of the items in figure 1, page 6.

Two sergeants drowned after the boat they had borrowed for fishing capsized on a windy day in the rough and choppy water of a large river. One was wearing a ski belt, the other no life preserver at all.

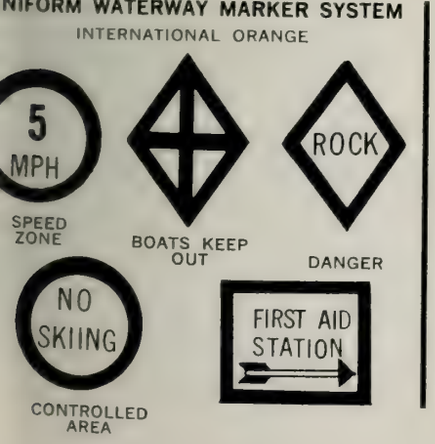
The water near dams can be quite dangerous. Water levels may change drastically and boats may be exposed to stumps and other obstacles. Sometimes there are strong currents and the area may not be marked in any way. A sergeant attempted to dock his fishing boat without use of the motor and was swept over a spillway and drowned.

A dangerous practice, often done out of ignorance, is that of overloading a boat. The US Coast Guard says overloading and improper loading are the most common operator faults. The boat should be loaded evenly, keeping the load low in the boat. Loads, including people, should not exceed the capacity shown on the manufacturer's capacity plate. Some states, however, do not require such a plate and the manufacturer may not supply the information. If that's your case, you can get some info by writing the Coast Guard for a free pamphlet, "Pleasure Craft" (CG-290). The pamphlet also contains a wealth of other information on boat equipment and requirements.

SCUBA

Scuba diving is a specialized sport requiring the participant to be a strong swimmer and to have the knowledge and equipment to pursue the sport safely. Most scuba accidents result from a lack of one or more of these requirements.

Part of knowledge is knowing one's limitations, probably the most



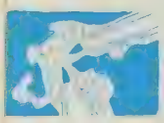




Sailing is great sport but requires training prior to venturing out into open water.

Figure 1

UNSAFE BOAT OPERATION



Excessive speed in close proximity to other boats, in narrow winding channels where visibility is reduced, and during periods of reduced visibility.



Overloading of vessels beyond manufacturers recommended safe loading capacity.



Operating a boat while under the influence of intoxicants or drugs.



Towing water skiers in the close vicinity of other vessels or obstructions.



Operating boat within swimming areas where bathers are present.



Operation of boat in vicinity of dams and other known hazardous areas.



Other unsafe operating practices include:
Bow, gunwale, transom, and seat back riding.



Ignoring weather and storm warnings.



Not using an observer when towing a water skier.



Not maintaining a proper lookout ahead of the vessel for debris, other boats, persons in the water, etc.



Failure to observe the Rules of the Road.



Operating vessel without regard for possible damage which the boat's wake might create.

critical part of any demanding activity with an element of danger. Consider the following:

• A SSgt was making his certification dive. His weight belt was grossly overloaded with 34¾ lbs. He exhausted his air supply, became separated from his companions and surfaced. The weight of the belt plus his tanks caused him to panic and drown.

• A captain was very fatigued when he began a series of demanding dives. After five hours during which he made dives of 60 and 38 minutes, he made his third and the fatal dive. With the twin tanks and 16 lbs of weight, he was carrying 90 lbs. When they encountered a heavy surge, the captain and his buddy decided to surface and go ashore. The captain had made it to a rock, where he removed his mask and mouthpiece, when a wave swept him from the rock. By this time he was exhausted and made no attempt to jettison his tanks and weights. In trying to release the captain's weight belt, the other diver mistook the tank harness for the weight belt.

Skin and scuba diving have become major sports. Both are safe, fun and interesting if participants know their limitations and do not exceed them. Skin diving requires good swimming ability and good health. So does scuba but it is more demanding in that the participant must know his equipment and understand the use and effects of compressed gasses. Both skin and scuba diving have the same rule: *never go alone*. That's right—the old buddy system. It's also a good rule for all water sports. Sometimes, although there are many people about, you may be in truth alone. In the midst of bathers one man drowned, with no witnesses. Hence the requirement for supervised swimming and the buddy system.

It's hard to believe that a person who couldn't swim would go out in an 8 foot boat on a river with a strong current. Well, two sergeants did, the boat overturned and the non-swimmer drowned.

It's hard to believe that an airman would take a running dive off a 3 foot bank into 2 feet of water. One did, broke his back and suffered paralysis from the shoulders down.

Probably we can't prevent every act of poor judgment, but we can try. For water sports each base must maintain an effective education and training program. Most bases have such programs. But the responsibility really rests with the individual. Anyone who indulges in water sports without the essential knowledge, ability and equipment is a fool. Take advantage of your base water safety program where you'll probably see a film TF 6115 "Drown Proofing." That is a technique developed by Fred Lanoue, a former swimming coach at Georgia Tech. If you are a non-swimmer, at least learn a technique like that before you put a foot into the water. It could save your life.

There is more to boating than making payments on the boat. You gotta learn something about the thing. Your dealer can help, chances are there is a Coast Guard class available at a nearby high school or college, or you can get all kinds of free or inexpensive literature from the Coast Guard. You may be able to get info from your state; most states have laws governing the operation of pleasure boats.

There should be few, if any, outright novices trying to go it alone at scuba diving. But there undoubtedly are some who have only marginal ability. Don't push your luck. Scuba is a demanding, as well as rewarding, sport. Perhaps a bit of paraphrasing would be appropriate. The sea, like the air, is not inherently dangerous but it is extremely unforgiving of . . . (ignorance and foolhardiness.) Keep that in mind and you'll be around to enjoy snow skiing next winter. ★

THE IFC APPROACH

By the USAF INSTRUMENT FLIGHT CENTER
Randolph AFB, Texas, 78148

Q: Can I use an "IFC Approach" article as the authority to change a manual or a regulation?

A: No. The information in the "IFC Approach" article is *only informative in nature*. Changes to an Air Force Manual or Regulation must be accomplished through the OPR.

Q: While in-flight, I was unable to contact Center on the radio. I called a Flight Service Station and requested a change to my clearance. His response was "Roger." Did "Roger" mean I was cleared as requested?

A: No; "Roger" means, "I have received all of your last transmission." To receive a valid ATC clearance, information, or an ATC request from a non-ATC facility, the transmission should begin with one of the following phrases: "ATC clears", "ATC advises", or "ATC requests."

Q: The published IAF altitude for a TACAN teardrop penetration approach is FL 220. The penetration turn is defined as a DME fix. I am cleared for the approach at FL 200. Can I apply 15 seconds per 1000 feet flyoff to this approach?

A: Yes; but it is not required. The flyoff procedure is designed for non-DME approaches. Where an approach is designed using DME, merely comply with the appropriate altitude/DME restrictions. When DME is not used, the 15 seconds per 1000 feet flyoff is used to ensure sufficient outbound and inbound time for altitude loss prior to FAF.

HELICOPTER PILOTS

Q: What is a special VFR clearance?

A: A special VFR clearance is an ATC clearance to operate within a control zone when weather conditions are less than basic VFR weather minima (1000 feet ceiling and 3 miles visibility). The flight must be conducted clear of clouds and the forward speed must permit an adequate opportunity to see and avoid any other traffic and obstructions to flight.

Q: When is a special VFR clearance issued?

A: A special VFR clearance is issued only if the pilot requests it and the weather conditions reported at the airport of intended operation are below basic VFR conditions. A special VFR clearance may also be issued if the airport weather has not been reported and the pilot states he is unable to maintain VFR and requests a special VFR clearance.

Q: Can I expect to receive a special VFR clearance in all control zones?

A: Presently there are no control zones which prohibit special VFR to helicopters.

Q: Can a special VFR clearance be requested and issued during hours of darkness?

A: Yes; however, AFR 60-16 states that helicopters are expected to fly IFR at night insofar as practical.

Q: Can I file a VFR flight plan and fly VFR enroute to a destination with forecast weather less than basic VFR? I plan to get a special VFR clearance at destination to enter the control zone.

A: Yes. Basic VFR weather in a control zone is 1000 feet ceiling and 3 miles visibility. If the weather at destination is less than 1000 feet ceiling or less than 3 miles, you will need a special VFR or an IFR clearance to enter the control zone. A special VFR clearance is not automatic because it depends on other air traffic and the actual weather conditions. If the weather conditions are low enough at destination to require a special VFR clearance, the pilot should definitely have a backup plan of action to follow in the event the weather deteriorates. An alternate airfield is not required for a VFR flight, but it is desirable to have one in this type of situation.

Q: If I fly a fixed-wing approach in my helicopter at 110 knots, am I still considered a Category A aircraft?

A: FLIP states that all US military helicopters *may* utilize the aircraft approach Category A minimums published in FLIP publications. Approaches with Category A minimums are designed for a maixmum airspeed of 90 knots. Therefore, if the approach is flown above 90 knots, the approach category appropriate to the airspeed should be used. This also applies for a circling approach. The size of the maneuvering area which ensures required obstacle clearance is a function of airspeed. (When this article was written, action had already been initiated to incorporate this information in AFR 60-16 and FLIP.)

Q: Do "Copter Only" approaches have a different missed approach climb gradient than fixed-wing approaches?

A: Yes. The missed approach climb gradient for a "Copter Only" approach is 304 feet per mile as compared to 152 feet per mile for a fixed-wing missed approach procedure. If an obstacle in the missed approach segment requires a steeper climb gradient, the approach chart will depict the vertical velocity required. ★



the drag bag

On most Air Force fighters and the B-52 there is an innocuous little item that does not seem to receive the attention it deserves. That item is the drag chute, a device designed to retard the aircraft during landing roll.

Normally, few of us give much thought to the drag bag but when you need it, you need it, and its failure to perform can mean the difference between a normal event and something we'd rather not experience again. To illustrate, the scene goes something like this:

"RCR 14, aircraft landed 1000 feet down the runway. When the pilot deployed the drag chute, it fell out onto the runway. . . ." The story may go on to describe blown tires, a missed barrier engagement, an aircraft off the end, or the side, and perhaps a major accident.

Except when it is used in flight on some fighters, to assist the pilot in maintaining or regaining control during a departure or spin, the drag chute is one component of a system designed to decelerate a rolling aircraft. It is part of the redundancy built into the stopping system when we do not have a single, guaranteed, always effective method of stopping.

The system begins with the pilot's finesse in making a controlled on-speed landing and progresses to aerodynamic braking (some aircraft, for example the F-105), to brakes, including antiskid, to BAK arresting systems and finally an MA1A barrier.

Normally there is no need for the barriers and the aircraft slows and can be stopped with no sweat. At other times one thing or another fails and each item in the system becomes critical. Sometimes they all fail, with very bad results.

The foregoing is primarily for the maintenance guys, to give you a feeling for the importance of that little bag in the tail of the fighter you crew. Pilots know this but they are not always blameless when the drag bag doesn't work as advertised.

FIGURE 1
DRAG CHUTE FAILURES

B-52	20
F-4	39
F-100	36
F-101	6
F-102	2
F-104	2
F-105	15
F-106	18
U-2	1
Total	139

The reason for this article is that there are too many drag chute failures due to human error. During 1973 and 1974 there were 139 drag chute failures reported. The number for each aircraft type is shown in figure 1. Most of these failures caused no problems. But remember what we said about the drag chute being *one* component in a total stopping system. Then think about the consequences of other components failing. We'll give you an example pretty soon.

Since the drag chute plays such an important role, it deserves first class treatment all the way from buildup in the parachute shop to installation and inspection in the aircraft. When that is not the case, we have experiences such as the following:

- . . . F-4E, nr 2 in a flight of 3, touched down at 700 feet on a wet runway. No chute, BAK-9 engaged at 80 kts. The cause was obvious: the drag chute had not been reinstalled after being removed for aircraft maintenance. During preflight neither crew chief nor pilot noticed that there was no drag chute installed.

- Just after touchdown, the drag chute fell out onto the runway. RCR was low and the pilot of the F-4 could feel the antiskid cycling so he went for the hook. Now this









is one of those cases where nothing seemed to be going right. First the drag bag failed, and braking was poor because of the wet runway.



Next the hook wouldn't deploy. Fortunately there was an MA1A barrier, which stopped the aircraft in the overrun. In this case, the chute was incorrectly installed and the crew chief didn't notice it during inspection.

• One minute after takeoff the drag chute in an F-100 deployed and jettisoned. The chute went because someone used too much muscle and not enough good technique to install the chute and bent the door latch handle.

• Here's a case in which someone made a mistake which could have caused an accident if the F-100 pilot hadn't done an outstanding job to salvage the situation. The drag chute system malfunctioned, which allowed the chute to jettison. The bolt that connects the upper bell-crank to the teleflex telescopic unit was found lying in the drag chute compartment without the required castellated nut and

the DRAG BAG continued









cotter pin. After the drag chute failed, the left brake locked and the tire blew out. Finally in order to maintain directional control, the pilot had to blow the right tire and managed to stop on the runway.

• An F-105 was landing on a runway with a wet to dry ratio of 2.23, which would require more than 10,000 feet of runway after td in which to stop. There wasn't that much. After td the chute didn't work because it was improperly installed, then the hook was held off the runway surface by dynamic water pressure. Due to the wet runway and a cross-wind, the aircraft had drifted to the right side of the runway and the hook hit a threshold light which caused the hook to skip over the BAK-9 pendant. The aircraft engaged the MA1A barrier but the cable failed, as did the landing gear when the aircraft left the runway and rolled into a soft, marshy area. See what we mean by the importance of each component of the total system?

Not all of the problems, of course, are human ones. Materiel failures are numerous and, in some cases, repetitive. Perhaps there wouldn't be so many repeats if we were a little more diligent about using UMRs.

Better inspection by maintenance to ensure correct assembly and installation and to detect signs of deterioration caused by corrosion and wear and tear will solve many of our drag chute problems. Pilots too can contribute by taking more than a casual look at the drag chute installation during walkaround. They have a primary interest in whether the system works.

So what have we said? That drag chutes are an important part of the aircraft deceleration system; that they sometimes fail; that failures resulting from human error and materiel deficiencies can be prevented by following the book for assembly and installation and by using the material deficiency reporting system. And last, careful inspection during maintenance preflight and pilot walkaround should ensure that the bag will blossom when it's needed. ★

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18 TACTICAL FIGHTER WING (PACAF)

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TEAMWORK can make a big

"Hero 14, contact Atlantis Approach Control on 253.9."

"Hero 14, Roger. . . . Atlantis Approach Hero 14."

"Hero 14, this is Atlantis Approach Control, verify current altitude is three thousand-two hundred."

"Hero 14, Roger."

"Hero 14, this is Atlantis Approach Control, verify current altitude is three thousand-two hundred."

"Hero 14, ROGER! !"

"Hero 14, Atlantis Approach, understand your altitude is three thousand-two hundred."

"Hero 14, Roger!" At this point you, the pilot of Hero 14, are thinking to yourself, What a dummy this controller is; I had to tell him three times that my altitude is 3200 feet. This guy must be brand new, but nobody said anything about "controller training in progress. . . ." Oh well, they probably forgot that too! Good thing I'm flying an ILS or, even though it's a clear night, I might really be in trouble!

"Hero 14, turn right to heading 180°, 6 miles from outer marker. Cleared for ILS rwy 18 Approach, contact Atlantis GCA on 236.2, over."

"Hero 14, Roger 180°." What are those guys doing now? Why am I going to a GCA freq? Oh well. . . .

"Atlantis GCA, this is Hero 14."

"Atlantis GCA, this is Hero 14!"

"ATLANTIS GCA, THIS IS HERO 14!"

Boy, those dummies! Can't even give me the right freq!

"Hero 14, Atlantis GCA on guard, contact Atlantis GCA on 263.2!"

"Atlantis GCA, this is Hero 14."

"Hero 14, Roger this is Atlantis GCA. You are passing outer marker. Check wheels down, cleared to land runway 18, approach will be radar monitored."

"Hero 14, outer marker, gear check, full stop."

I didn't *ask* for a radar monitor!!

"Hero 14, well right of PAR course drifting farther right."

I know it, I'm correcting. What's the matter with those guys. I saw the runway miles ago. I didn't ask for a radar monitor!

"Roger, I'm correcting!"

"Hero 14, too far right for safe approach; if not visual execute a missed approach!"

"Hero 14, I'm visual, it's VFR out here guys!" I don't care if that is a new guy, there was absolutely *no* excuse for that! !

Unfortunately this sort of situation develops much too frequently. Let's examine this scenario and see where improvements could have been made if a little understanding and knowledge had been included. For the sake of brevity and, since I am a pilot and am talking mainly to pilots, the pilot in this scenario is going to be the bad guy.

First of all, according to the FAA Terminal Air Traffic Control Manual 7110.8D, the radio term "Roger" means "I have received all of your last transmission." To a controller this is *all* it means! When you are asked to verify your altitude, answering with "Roger" just doesn't satisfy the request. What the controller is listening for here is for you to actually tell him your altitude, or whatever you've been asked to verify. The pilot should have said, "Hero 14, level three thousand-two hundred." If you don't answer in this manner he will

CAPTAIN ROBERT S. HINDS
Directorate of Aerospace Safety

DIFFERENCE

have to repeat his request or word it in such a way that your Roger does answer his question.

Now, what about this "controller training in progress" business? Well, 7110.8D at one time did require the controller to tell you when training was being accomplished. Recently this requirement was changed. It is no longer required that you be told when training is being accomplished. Realistically, this hasn't changed our way of operating much. Pilots should be just as alert with a qualified controller as they are with a trainee. Under the old requirement, when you were told "controller training in progress" this training could have been for a brand new controller just out of school, or for a controller with 20 years experience who was checking out at a new base or in a new job. In either case there was and still is a fully qualified supervisor watching every move the trainee makes, ready to step in should any problems arise. Now, since we won't be told when training is in progress, it's even more important for the pilot to play fair and follow the corrections the controller gives, no matter what the weather. We will not only maintain our own proficiency but will be doing the same thing for the controller, and that could really be important the next time we try a GCA with the weather approaching minimums. Don't totally depend on the controller on any approach, for, after all, the pilot has the ultimate responsibility for getting the aircraft on the ground *safely!*

The next two points in the scenario came pretty fast, so maybe you missed them. First, when handed off to a final controller, have a plan of action as to what you are going to do in case you have trouble establishing radio contact. Don't waste valuable time making repeated attempts to contact the final approach controller on only one frequency. You might have requested a backup frequency if you have both UHF and VHF aboard. The tower could get you a frequency even if you had to go missed approach on this attempt. Don't forget the approach control frequency you just left, you could always go back to it and tell them you couldn't establish contact. Of course, if you've been issued lost communications procedures, follow them. The biggest point here is to have a plan in mind and do it as quickly as possible! Then you'll have a little more time to handle the situation.

Second, the pilot in Hero 14 couldn't understand why he was being radar monitored since he hadn't asked for it. Well, 7110.8D requires a precision or nonprecision approach be radar monitored when the PAR final approach course coincides with the navaid final approach course and one of the following conditions exists:

a. The reported weather is below basic VFR minimums,

b. At night

c. The pilot requests it.

In this case the approach was at night so the controllers had no choice but to provide radar monitoring.

The last point in the scenario is that controllers are bound by rules and regulations just like the pilots. AFM 51-37 tells a pilot that he must discontinue his ILS approach if the localizer course becomes unreliable, or any time full scale deflection of the CDI occurs on final. Likewise, 7110.8D tells a controller that, while monitoring an approach, if after repeated advisories the aircraft is observed proceeding outside the PAR safety limits or radical target deviation is observed, he *must* advise the aircraft, "if unable to proceed visually, execute a missed approach." He has no choice in the matter. By the way, these PAR safety limits are really not very large, as the chart shows.

RANGE (NM)	FEET LEFT/RIGHT
6	1200
5	1000
4	800
3	600
2	400
1	200
½	100

And, of course, there are similar safety limits for the glide path portion of the approach.

There are many causes for misunderstandings between pilots and controllers not addressed in this article. Whatever we can do to alleviate these misunderstandings has to be in the best interests of us all. Check FAA 7110.8D or AFM 60-5 or AFCSR 60-5 for some of the rules and regulations that controllers must follow. You'll probably clear up at least a couple of questions that could prevent a misunderstanding later on.

Remember earlier when I said the pilot was going to be the bad guy? Well, he was in this story, but this isn't always the case. Controllers need an understanding of pilot's problems just as much as pilots need to understand controller's problems. But that's a good topic for another article. Just remember: When the weather's bad and the fuel is about gone . . . good *teamwork* between pilot and controller *can make a big difference!* ★

OPS TOPICS

IFR IN THE COCKPIT



During his preflight checks the AC of an F-4 set the defo and temperature controls to full hot. About 7 minutes after engine start, the AC set the controls for takeoff. Everything was fine until 120 knots on takeoff roll when the canopy fogged over. The AC selected full hot on the defog and temperature, but he was unable to clear the canopy quickly enough to prevent the F-4 from leaving th runway. The aircraft got airborne safely, and after the canopy cleared the crew made a successful landing. This mishap was the result of a malfunctioning temperature sensor which allowed cooler than normal air into the cockpit. This, combined with a temperature-dew point spread of 2 degrees, caused the fogging condition. Although the pilot probably could not have prevented this incident, each pilot should be aware of the hazards of windshield fogging on takeoff. Most dash 1's like the o for the F-4 suggest preheating the canopies/windshields before takeoff in high humidity conditions.

TWO WRONGS DON'T MAKE A RIGHT

The T-38 crew noticed that the right generator was out ar the right hydraulic system was reading high. The AC reported this to the RSU then noted that hydraulic pressure was now zero and the right generator would not reset This was also reported to the RSU controller who did not acknowledge. The RSU controller then directed the right engine be shut down, which the pilot did, and the aircraf completed a single engine landing. The procedure of shut ting down the engine was proper for high hydraulic pressure but incorrect for the conditions actually in existence. The pilot had incorrectly interpreted the instrument indications and the RSU controller improperly directed an engine shutdown.

FLAT WHEEL



As the T-39 taxied out for takeoff, the crew felt "surges from the left brake. When they stopped to investigate, they found the left main wheel rim had failed. A piece o the rim about 12 inches long was found 100 yards behind aircraft.

ALMOST!

The Thud was nr 4 during a rejoin. As he was moving int position he lost sight of nr 3 in the sun. Nr 4 immediately reduced power and began a pushover. But he was no quick enough to prevent his windscreen and radome from striking the wingtip and stores on the right inboard station of nr 3.

Ode to a Dead Bird (Sea Gull, Maybe?)

On wings of feather I abound,
And leave the creatures of the ground.
There is no flight plan to which I adhere,
No ALSAFECOM or safety gear.
The safety frogs can croak all day,
But I pay no mind to what they say.
Freedom is the life for me.
Oops, I just hit a canopy!

By Capt Dan S. Baker, Chief of Safety, AF Iceland

OPS TOPICS

ANOTHER CLOSE ONE



The C-9 was in IMC on climb out, and the crew had been advised of traffic while they were still in the clouds. When the aircraft broke out the crew saw a green and white light plane flying just above the cloud tops. The C-9 took evasive action and missed the light plane by only about 100 to 200 feet.

ARE YOU READY?

The KC-135 was making a PAR approach in marginal weather. The aircrew did not have visual contact with the runway environment at decision height so they initiated a go-around. As the throttles were advanced nr 4 engine compressor stalled and had to be shut down. The "glitches" get you at inopportune moments.

MUDDY ROAD AHEAD



The T-38 jock had trouble seeing as he was taxiing because the windshield was fogged over. This, combined with an equipment malfunction which diverted his attention, caused him to miss a turn in the taxiway and end up axle deep in mud.

GEAR ON ICE

When the C-5 crew attempted to extend the gear for landing, the right forward main gear remained "in transit." The crew could not solve the problem in flight and eventually made an uneventful landing on the aft mains. After landing, they found accumulations of ice around the gear door locks which prevented the locks from opening. The water had come from a leak in the troop compartment galley system and latrine.

LIQUID FOD



After takeoff the KC-135 landing gear would not retract. Some trouble shooting by the crew got the gear up; then several minutes later smoke began coming from behind the copilot's portion of the instrument panel. The landing gear CB popped, and the smoke stopped. After landing, inspection showed that someone had spilled either coffee with sugar or a soft drink on the instrument panel. The liquid had leaked down into the landing gear lever lock solenoid coil, causing it to burn out. The crew had not spilled anything during the incident flight nor had there been any 781 write ups reflecting liquid spills in the cockpit.

ALTITUDE WARNING

The FAA is adding a "minimum safe altitude warning" capability to its ARTS III systems. This system will automatically trigger a visual and aural signal when an aircraft penetrates or is about to penetrate a predetermined minimum safe altitude in terminal airspace. It will also warn the controller of significant deviations in altitude. The system, which is designed to accommodate all the normal instrument approaches, will be installed in all 64 facilities beginning in Jan 76 with Los Angeles, Chicago O'Hare, Dulles International, Detroit Metro, Oakland International, and Houston Intercontinental.

NONPRECISION APPROACH



In its investigation of a recent accident, the National Transportation Safety Board determined that the probable cause was . . . "The captain's failure to exercise positive flight management during the execution of a nonprecision approach, which culminated in a deterioration of airspeed into the stall regime where level flight could no longer be maintained."

Generally, there is no single cause for any accident and cause assignment tends to oversimplify by omitting some of the events leading to the accident. There is concern, however, expressed by both the NTSB and FAA about the recurring indications of lack of crew coordination, adherence to standard operating procedures and cockpit discipline as causative factors in nonprecision approach accidents.

Today's pilot operates in an environment which emphasizes the philosophy of the Cat I, II and III ILS approaches but de-emphasizes basic nonprecision instrument approach procedures. This is a valid direction but until EVERY approach uses precision guidance, the pilot, when executing a nonprecision approach, must be ready to substitute his technique and judgment for the electronic guidance on which we have become dependent.

There are several common faults frequently noted in the execution of these so-called nonprecision approaches. These areas of difficulty usually can be broken down into three categories: knowledge, planning and execution. Knowledge, for instance, involves the factors upon which decisions are based—whether to start an approach, whether it's going properly and when to break it off.

Weather, of course, plays an important part in decision making. It has been shown in recent surveys that there is need to improve the knowledge and understanding of the implications of reported low visibility weather. Of particular interest is the fact that partial obscuration is described in the remarks section of the observation and can be anything from 1/10 to 9/10 obscuration and still be considered partial. The implication of a 7/10 or 8/10 obscuration is that a pilot could reasonably expect to encounter a restriction to visibility as he descends from a position below cloud level toward the runway environment. However, many pilots questioned were not aware of this because they did not relate the remarks information to the obscuration.

> "A superior pilot may be defined as one who stays out of trouble by using his superior judgment to avoid situations which might require the use of his superior skill."
>
> **Anonymous from British Airways AIR SAFETY REVIEW**

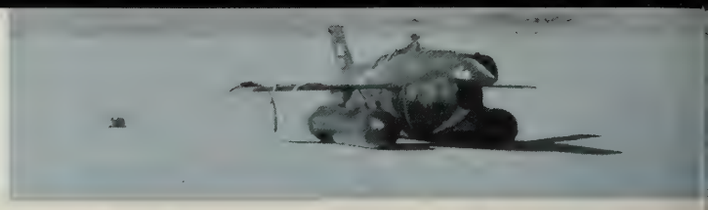
Most all successful instrument approaches and particularly nonprecision instrument approaches begin many miles from the final approach fix. The crew in the previously mentioned accident were slow in responding to speed reduction requests for spacing. In addition, the captain called for the final checklist 3.3 nautical miles from the runway. The first officer did not make any of the required altitude callouts and apparently was not monitoring airspeed and rate of descent because he and the second officer were executing the checklist. This lack of planning led the board to conclude that the "rush of cockpit activities during the final descent caused a breakdown of the safeguards inherent in the task sharing of the crew." The most competent pilot may fail to adapt if events occur that overload his capacity.

An aircraft to be effectively used has always required a satisfactory match of performance, controllability and instrument display which are within the mental and physical limits of the pilot. During a poorly planned approach there becomes a point of diminishing return where the aircraft demands exceed the pilot's capacity.

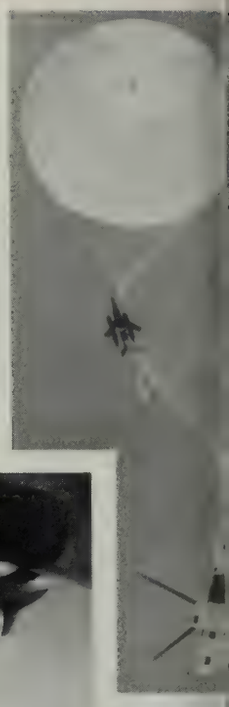
Our procedures are set up to get us over the final approach fix at the proper speed, gear and flap configuration so that there is literally nothing left to do except "fly the airplane." It is vital at this execution phase that the entire crew work together as a coordinated disciplined team. This is the only type of environment that will preclude a breakdown in the safeguards inherent in the task sharing of a crew which are set up in our crew coordination procedures.

Perhaps we should stop using the philosophy of nonprecision and face up to the simple fact that it takes more of the basic pilot skills to execute this type of approach than it does to follow a "yellow bird" to the runway. When the pilot becomes a substitute for a glideslope, flight director, or becomes a warning flag for an HSI, then it takes all the precision he can muster. We must know and practice the basic skills and techniques so that we may remove the "non" from nonprecision approach. *(From British Airways Air Safety Review.)* ★





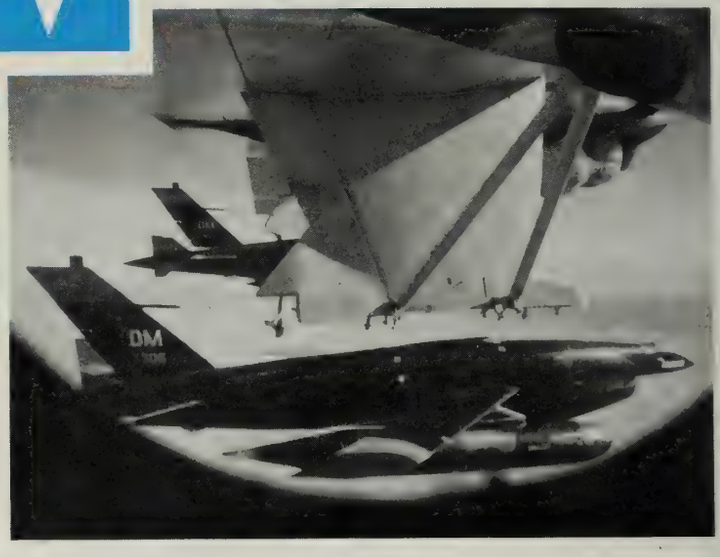




THE RPV*

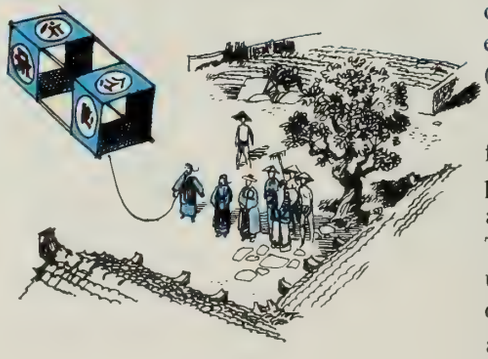








*The remotely piloted vehicle



A combination of new technology, economic constraints and improved air defense systems has focused military attention on the development of a new generation of remotely piloted vehicles (RPVs).

During the Southeast Asia conflict the target drone evolved to perform operational, reconnaissance and electronic warfare functions. The next generation of RPVs offers unique capabilities for tactical strike, defense suppression, reconnaissance and electronic warfare, with possibilities already perceived for extending the RPV role to interdiction and air-to-air combat. Before looking into the future of this revolutionary concept of aerial warfare, the past and present state of the art is explained in chronological sequence.

About 400 B.C. the first kite flight was recorded in China and marked the beginning of remotely controlled aircraft. True, the aerodynamics of the kite's shape left something to be desired; it had limited range, was of little military value and the down-link was a piece of string, but history was being recorded. Little progress was made from the flight of the kite until the beginning of the twentieth century.

BUGS AND BLIVETS

In 1915, the first attempts were made to launch an unmanned powered aircraft. After three years of research by C. F. Kettering, the first drone was flown. Known as the Kettering Bug, this vehicle was a biplane using a reciprocating engine. This initial program produced no military application, but recommendations and procedures from Kettering's research led to the first successful droning of a commercial Curtis Robin in 1928. The radio controlled, bomb-carrying aircraft was tested for the next four years until 1932, when research was discontinued for the lack of appropriations. Six years passed before any serious interest was shown by the armed forces in the development of remotely controlled offensive weapons.



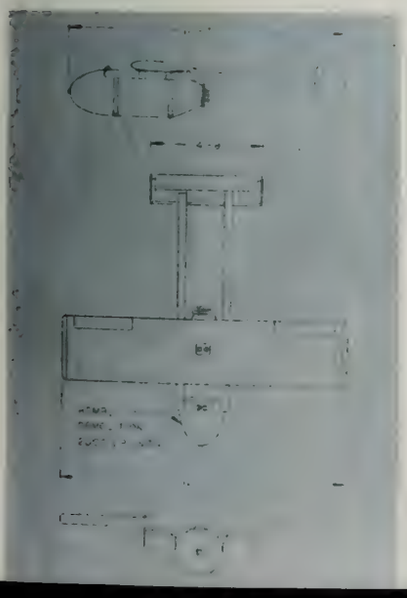
The Kettering Aerial Torpedo, known as the "Bug," built in 1917-18 but never saw combat. Bug had 55 mph speed and 40-mile range. This bird is in USAF Museum at Wright-Patterson AFB.

In 1938, General Henry (Hap) Arnold, Chief of the Air Corps, sought the assistance of Kettering in resuming research on a new arsenal of special weapons. Among the special projects was the development of radio controlled target planes of the PQ series, a glide bomb (GB-1), a controllable high angle bomb known as AZON, a glide bomb known as the "Bat" and several other projects which were subsequently discontinued. Of these experiments, the GB-1 proved to be most effective.

The GB-1 marks the beginning of our first stand-off weapon. A 2000 pound bomb fuselage, with twelve foot wings and twin plywood rudders was dropped by B-17s and visually guided to the target by radio control. In 1943, 54 B-17s from Eighth Air Force, carrying 108 GB-1s struck the city of Cologne. The German report of the strike was: ". . . *high altitude bombers against Cologne has been turned back by fierce anti-aircraft fire defending the city, and no bombs were dropped. The accompanying fighter cover, however, composed of small, exceedingly fast twin-tailed air craft, came over the city at low altitude in a strafing attack. Every fighter was shot down; much damage was done by falling aircraft all of which exploded violently.*"

During the remainder of World War II RPVs saw little action. An attempt to drone B-17s and B-24s was abandoned because the cost was prohibitive. The German V-1 "Buzz-Bomb" was duplicated and released for production in the winter of 1944-45, but it was never used in combat.

After World War II, RPV programs were greatly accelerated. Attention focused on three different types of unmanned aircraft. These three types—low, intermediate, and high performance—were to be used as targets. In 1946, the low,



Glide Bomb (GB-1) developed in World War II, drawing at left, deployment from B-17 at right. It was used only once when 108 were dropped on Cologne.





Ryan Firebee mounted on wing of B-26. Photos at right show target drone dropping from B-26, and F-86 closing in to fire.

OQ-19, and intermediate, Q-1, performance targets were designed and built by the Radioplane Company of Van Nuys, California. The OQ-19, now known as the KD2-R5, is still in limited production.

ENTER THE FIREBEE

Industry attention, however, was centered on the high-performance jet target designated as the Q-2. Thirty-one companies responded to the first request for bids, but none was accepted. In 1948, the contract bidding was reopened with 18 aircraft manufacturers responding with 14 different designs. In August 1948, the Ryan Aeronautical Company was awarded the first contract for a subsonic, jet-powered unmanned aircraft.

The original specifications for the Q-2 called for both an air and ground launch capability. The first air launching was from the wing of a B-17 bomber, but eventually, a modified B-25C light bomber was adopted as the standard launch vehicle. Ground launch experiments started with 4000 foot rails and drone engine power. The rail length was decreased to a 90 foot catapult and the engine was augmented with the thrust of a standard six-inch naval gun. Next, a zero length launch with the added 11,000 pound thrust of a jato bottle proved unsuccessful. Eventually the combination of the jato and an eight-foot rail for initial stabilization was successful. This launch system is currently in use.

The basic Firebee that emerged from this testing was purchased by all three services in 1951. After more than 24 years service, this basic vehicle is still in use by the Air Force. Known as the BQM-34A target drone, this vehicle became the forerunner of all RPVs now in the Air Force inventory.

A NEW MISSION FOR DRONES

Aside from minor changes, no significant steps were taken to adapt the Firebee to other missions until June 1964. Impetus was then provided by the loss of an Air Force U-2 and its pilot. Since that time, a whole series of vehicles has been created which are capable of conducting low and high altitude reconnaissance and chaff laying missions. This was accomplished by extending the fuselage, providing a variety of wing configurations and using engines capable of meeting various mission requirements and accommodating different payloads. In all, about 900 of the AQM-34 series RPVs were built. Even today, additional vehicles are being pro-



Firebee launch from rail with JATO assist. Drone has been in service for 24 years.





duced and new configurations are being developed.

The use of these vehicles was so extensive in Southeast Asia that operations personnel jocularly referred to their area of operation as the "Tonkin Gulf Test Range." The successes achieved by these vehicles were outstanding. Many of the photos of targets and target damage in Southeast Asia released for the press were obtained by the low altitude reconnaissance version.

Improvements are continuing to be made in the AQM-34 series of RPVs. Demonstration tests have been successfully conducted in which a strike version, designated the BGM-34B, delivered ordnance against targets of various kinds. Weapon delivery was accomplished by using a nose mounted television camera which permitted the pilot sitting in the rear of a DC-130 to select the target and release the weapon.

Operational use of this capability is still some years away. A program is now underway to produce an RPV, the BGM-34C, which will be capable of conducting either reconnaissance, electronic warfare or strike missions. This will be accomplished by providing modular payloads which can be added or removed from the basic vehicle. If an EW mission is required, then the EW nose will be installed on the RPV. If a reconnaissance mission is required next, then the EW nose would be removed and a reconnaissance nose installed. Similarly, a strike nose would be installed if a strike mission were required. Flight tests of this RPV should commence during CY 1976.

DRONE APPLICATIONS CONTINUE TO EXPAND

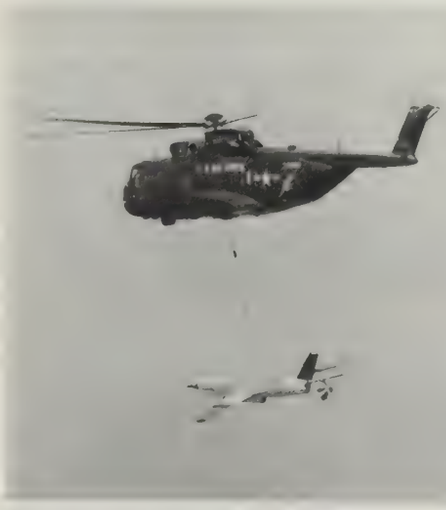
Although the Air Force has been singularly successful in use of RPVs derived from the Ryan Firebee, we are working on other classes of vehicles as well. One of these is TEDS (Tactical Expendable Drone System). As the name implies, this concept involves the use of low cost vehicles which can carry an electronic warfare payload. Vehicles of this type would be used in conjunction with a manned strike force, penetrating deep into enemy territory. A prototype demonstration program has just been initiated which will use vehicles developed under the Army's variable speed training target program. The effectiveness of the TEDS concept will be evaluated in conjunction with the TEDS flight test program scheduled to start in 1976.

Another type of RPV is represented by Compass Cope. Presently two different prototypes have been built and test flown; one by the Boeing Company and the other by Teledyne Ryan. These vehicles are large, weighing two or three times the heaviest of the AQM-34 series. Both are intended as high altitude, long endurance vehicles suitable for reconnaissance and communications relay. Recently, one of these vehicles set an unofficial endurance record staying aloft for more than 24 hours. Unlike the AQM-34 series of RPVs, the Compass Cope vehicles use conventional runway takeoff and landing techniques. This eliminates the need for launch and recovery support aircraft.

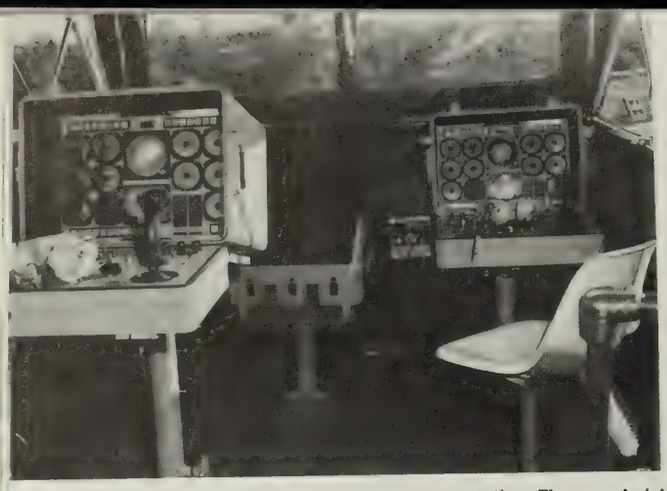
Presently, takeoff and landing of the Compass Cope prototypes are accomplished manually. Operational versions would include an automatic landing capability similar to those used on the Boeing 747, Lockheed L-1011, and McDonnell Douglas DC-10. Simulation to define an appropriate automatic landing system is now in progress at the Air Force Flight Dynamics Lab.

The Compass Cope program represents the most recent version of high altitude, long endurance RPVs. Forerunners were the Compass Dwell, the AQM-34R, and the Compass Arrow vehicles. Of these, only the AQM-34R has seen operational use. Whether the Compass Cope will enter the operational inventory will be decided at a series of important milestones. The first milestone is expected to take place late this year when the DOD must decide if sufficient merit exists to proceed into engineering development.

Today's RPV technology is being applied also to the target fleet in order to provide realistic threat simulation for testing of our advanced air-to-air weapons. The Pave Deuce program, developed by Sperry Flight Systems, applies ingenious remote control concepts

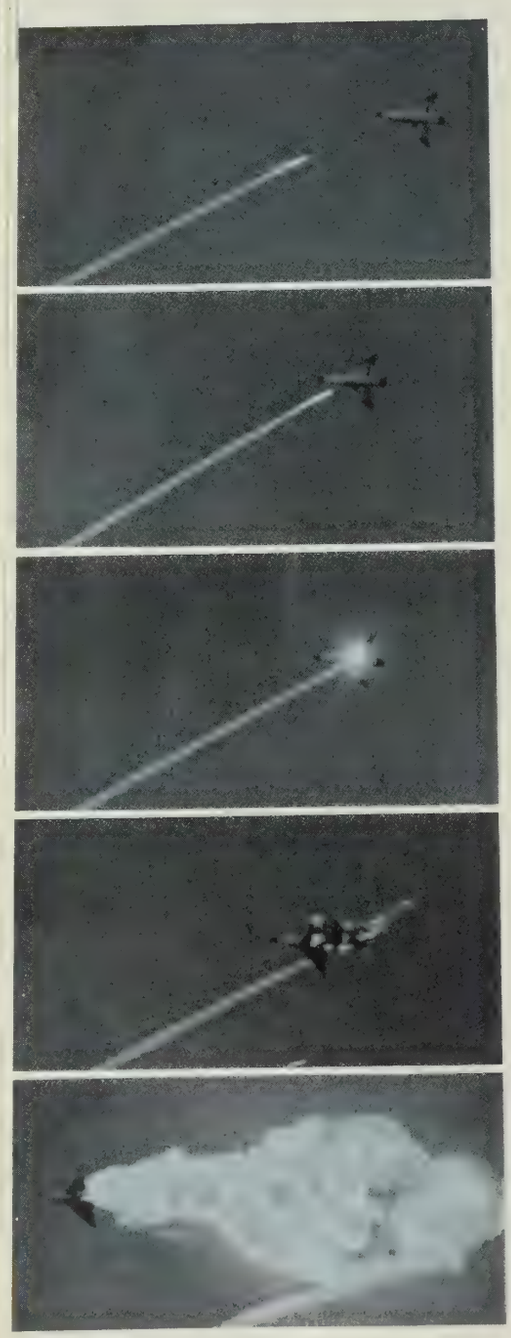


Target drone after recovery by helicopter. New series perform a variety of missions.





Left, control consoles inside mobile ground station. These control takeoff and landing of PQM-102, modified F-102 interceptor, shown during remotely controlled takeoff.



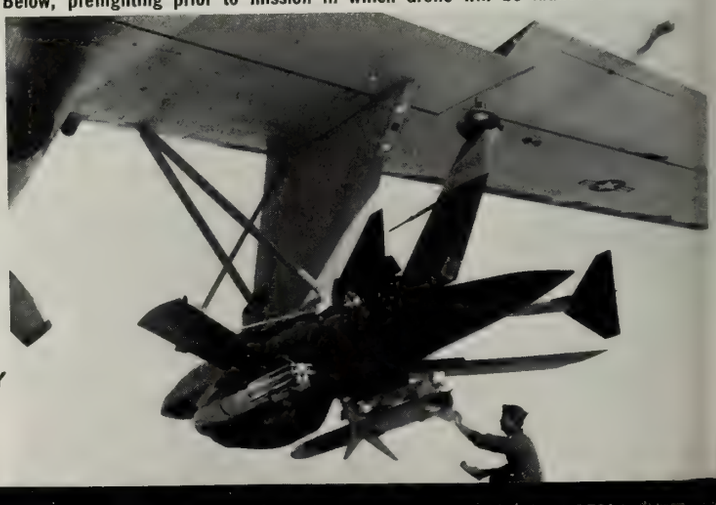
and redundant safety features to satisfy the need for a high speed, high altitude, full size afterburning target using the basic F-102 aircraft. The BQM-34F Firebee II is a highly maneuverable target with both high and low altitude supersonic capability and provision for aerial retrieval.

One mission area which does not appear promising for RPVs in the near future is the counter air mission. Although this mission stimulates the imagination of the casual observer of RPV programs, counter air presents a number of special problems. Principal among these are the tasks of providing the vehicle with sensors that are capable of detecting, locating and recognizing enemy vehicles. However, enemy vehicles might be at any location from the RPV—that is above, below, behind, to the right or left, and combinations thereof. Furthermore, these sensors must be compact and produced at relatively low cost. The combination of these features and the complex tasks which must be accomplished is certainly a challenge for the future.

SAFETY IS A PRIME MOVER

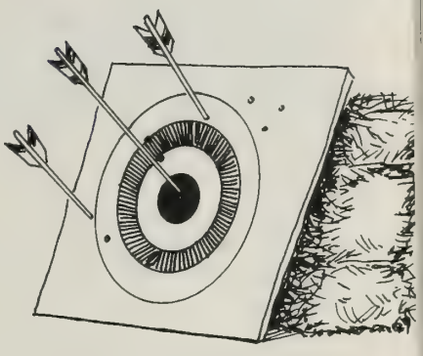
The primary driving force behind the development and use of new drone systems is none other than safety—the accomplishement of important high-risk missions without the accompanying risk of aircrews and expensive aircraft assets. A basic advantage to the use of unmanned systems is the comparatively low cost of non-manrated vehicles produced for specific purposes, high exposure and limited life. Providing cost-effective RPV systems tasks the drone community with the development of a sound approach to hardware specifications and performance standards which provide an optimum balance between safety and economical mission accomplishment. ★

Sequence at left shows AIM-9L Sidewinder destroying remotely controlled PQM-102. Below, preflighting prior to mission in which drone will be launched from C-130.



MISSILE TOPICS

ZERO IN ON THE ACCIDENT PRODUCER



While the Air Force has a systematic and professional method for handling materiel failures, it has no counterpart method for working personnel failures. On the contrary, everyone seems to go about personnel failures in his own way. Although some commanders and supervisors are quite successful in preventing personnel failures, the statement can't be universally applied. Part of the problem is that we often fail to surface the real reasons behind human factor accident causes. When a human factor is identified, we have difficulty in determining what prompted the act (improper training, inattentiveness, neglect, shortcutting, etc.). Also, supervisors don't always select the most appropriate or effective corrective action (retraining often becomes a cure-all). The point is, we must "zero in on the accident producer" in some logical way if we are to substantially reduce our accidental losses. One final note, keep this phrase in mind, you will be hearing it more frequently in coming months.

"AGE" CAN BE DEADLY



A Titan II electronic technician received an electrical shock when connecting the battery power supply simulator to a 480 volt receptacle. The polarization guide pins in the receptacle had been worn, which permitted the technician to install the connector improperly (rotated 180 degrees). When you work around "old" equipment, be particularly alert for indications of wear which could present a hazard to you.

LEST WE FORGET



- Ten years ago a Minuteman missile was destroyed 23 seconds after launch because of a loss of control.

- Five years ago electronic power supplies in a Minuteman launch facility were overheated at a cost of $2,000 because an environmental control system key switch was left in the "OFF" position by maintenance personnel departng the facility.

- One year ago a Titan II missile aborted launch because of damage to a start cartridge initiator. The initiator failed to fire and finally caused partial collapse of a fuel tank.

An Airman in the not distant past
Said "I can get this job done fast."
So he flew as with wings
And skipped a few things
Then finished his task with a blast. ★

MR. WILLIAM A. THOMPSON
Warner Robins ALC
Robins AFB GA

RUST and OTHER PAINS



1.



2.

Corrosion is, among other things, a headache to everyone, especially to those of us who live in areas of high humidity. Things around the house rust and must be cleaned and painted. We polish and wax our cars. More serious, however, is corrosion of aircraft, because of the high cost of corrosion control and the serious consequences of not zeroing in on corrosion prevention and control.

The nature of corrosion requires that everyone involved in construction, repair, or maintenance of aerospace equipment be concerned with preventing and controlling it. If that includes you, then you should know something about the types of corrosion and the methods of prevention.

Corrosion can generally be classified as one of the following eight types: uniform attack, pitting, intergranular (exfoliation), galvanic, crevice, stress corrosion cracking, corrosion fatigue, and filiform. These classifications are based on either the appearance of the corroded surface or the characteristics of the corrosive action.

Uniform attack, as its name implies, occurs over the entire surface of a metal and is caused by direct action of the environment on the metal. Examples include tarnishing of silver and copper, and the fogging of nickel. The rate of uniform attack is very slow when it is caused by direct reaction of the metal or alloy with oxygen (in the air). The first indication of this type of attack on a bright (polished) surface is dulling of the surface. If attack continues, the surface will become rough and possibly frosted. Prevention is relatively simple. Most uniform attack can be prevented by proper selection of materials or proper use of adequate coating systems.

Pitting is a form of severe localized attack, and it can completely penetrate a metal or alloy. Pitting corrosion is one of the most destructive types of corrosion because the pits are small and hard to detect.

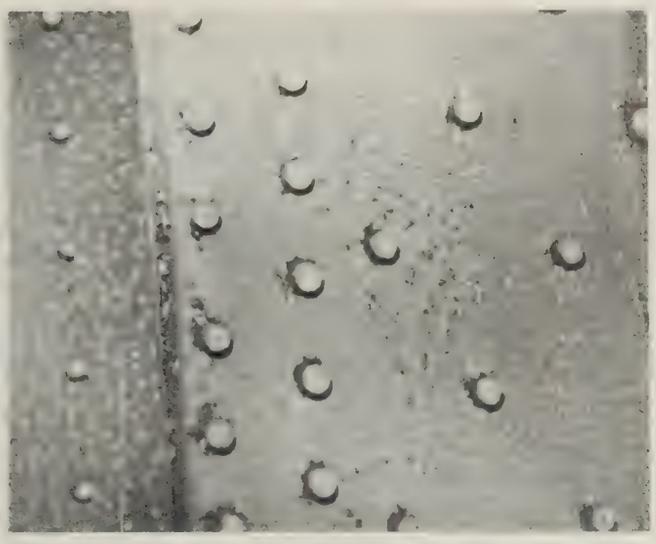
Pitting may occur in almost any alloy including aluminum and magnesium as well as in steels and stainless steel. A metal or alloy that tends to pit should generally not be used in aircraft; however, many of the alloys (aluminum and magnesium) used in aircraft are chosen for their light weight rather than for their corrosion resistance. Since these materials are extensively used, they must be protected. Some of the methods used to prevent pitting include adequate cleaning to prevent soil buildup, proper maintenance of protective coating systems, use of conversion coatings and sealants, and shot peening to reduce surface stresses.

Pitting on aluminum and magnesium alloys first appears as a white/gray powdery deposit. When the powder is brushed away, the pits can be seen. Pitting on steels (particularly stainless steels) can appear as a group of tiny holes, or, in a severe case, as an uneven, rough surface.

3.



4.

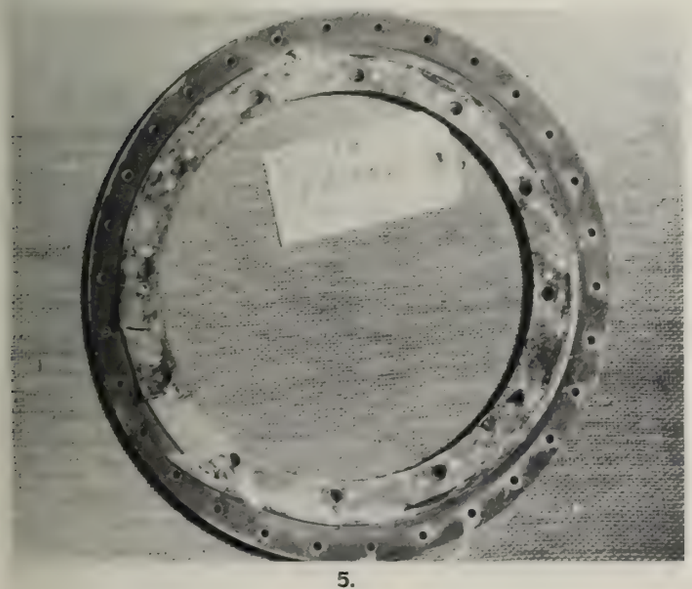


All metals and alloys are composed of small, individual segments (called grains) of the metal or alloy. Each of these tiny grains has a clearly defined boundary area. Intergranular corrosion is a type of concentrated attack at these grain boundaries. It can be caused by differences in composition between the grain boundary and the interior of the grain or by impurities which gather at the grain boundaries.

If a metal or alloy susceptible to intergranular corrosion is rolled or extruded as part of its forming, the grains tend to take on a flattened and elongated shape. When this form of alloy is exposed to a corrosive environment and intergranular corrosion occurs, the corrosion product will be larger than the original metal which corroded. The corrosion product will swell and push apart the layers of uncorroded material. This type of intergranular corrosion is referred to as exfoliation and can be thought of as similar to the pages of a book. As the grain boundary is forced open by the growing corrosion products, new material is exposed to the corrosive environment, resulting in further corrosion. Proper heat treatment of metals and alloys is the best method of preventing intergranular attack.

Galvanic corrosion, also known as dissimilar metal corrosion or contact corrosion, occurs when dissimilar metals or alloys are in contact and a conductive solution is present. This type of attack is the result of a natural difference in the chemical activity of metals or alloys. Since a detailed explanation of this type of activity tends to be quite complicated, the action that takes place in a dry-cell battery will illustrate galvanic action (corrosion).

A dry cell flashlight battery consists of three major parts: a carbon center post, a zinc case, and a moist paste. The potential difference between carbon and zinc causes a current to flow. As a result, the zinc corrodes since it is in contact with a corrosive environment (the wet paste).



5.

PHOTO CAPTIONS

1 Intergranular exfoliation of an aluminum alloy panel.
(1) Initial indications; (2) Advanced damage after removal of top layer.

2 Severe intergranular exfoliation of an aluminum alloy panel. Although initial indications of intergranular exfoliation may appear as areas (1) in Photo 1, resulting damage can be excessive as shown here.

3 Galvanic corrosion of an aluminum forging due to contact with a steel nut. There was no sealant between the two metals.

4 Pitting corrosion on a main wing rib of a cargo aircraft with accelerated corrosion around fasteners.

5 A combination of crevice corrosion and intergranular attack on an antenna adapter from a C-141 aircraft.

RUST and OTHER PAINS *continued*

Galvanic corrosion can usually be recognized by a buildup of corrosion products at the junction of the two metals or alloys. A Galvanic Series of commonly used alloys is available for determining the tendency of the alloys to corrode when in contact.

The most effective way to reduce galvanic corrosion damage is to select alloys (for contact use) that are located near each other on the Galvanic Series. When this is not practical, we can protect against galvanic corrosion by insulating the metals with inhibiting sealant material so they do not touch.

A type of severe localized corrosion which can occur under bolt and rivet heads, under gaskets, or anywhere a crevice is formed is referred to as crevice corrosion. It is also known as concentration cell corrosion, and the mechanism is similar to pitting. The conditions inside a crevice may be quite different from those outside. Materials such as cleaning compound and paint remover may enter a faying surface (crevice) and remain after rinsing. A crevice may also form under gaskets, under soil on a metal surface, and even under corrosion products. Once corrosion begins in a crevice, it becomes a self-sustaining reaction.

Because it occurs in areas not accessible for visual inspection, crevice corrosion is difficult to detect. The obvious method for preventing corrosion would be to eliminate all crevices; but, in practice, this is impossible. Therefore, other methods such as sealing faying surfaces and dipping fasteners in sealant before installation are used. This effectively eliminates the crevice.

Stress corrosion cracking is a result of constant tensile stress and corrosion occurring at the same time. The stress involved may be externally applied or internal. Stresses induced when a part is deformed during cold work, stresses caused by force fits, and stresses in fasteners are examples of internal stresses.

Stress corrosion cracking can occur in most alloys, but the ones of most importance for aerospace applications include some aluminum alloys, magnesium alloys, and high strength steels. It can be prevented by proper use of protective coatings and stress relief of susceptible parts. Stress corrosion cracking is a serious problem since it is generally difficult to recognize before safety factors are exceeeded.

Corrosion fatigue can be thought of as a special case of stress corrosion cracking. However, the stress in this case is cyclic (usually external), and the material fails due to a reduction of the fatigue limit as a result of corrosion. A corrosion fatigue failure is likely to exhibit several cracks in addition to the failure crack. Also, failures resulting from corrosion fatigue can generally be identified by multiple cracks branching out from the failure crack. Corrosion fatigue failures can be reduced by use of stress relieving heat treatment and by peening the surface.

Filiform corrosion gets its descriptive name from the numerous threadlike filaments which are formed as a result of this type corrosion. These filaments are corrosion products which appear under organic coatings and occur when oxygen and water get under the coating. The best preventive method is to ensure that a part is never exposed to high humidity by use of a protective coating.

Structural requirements generally dictate the materials to be used for a given application. Strength, weight, and cost affect the choice of materials, and corrosion resistance is sometimes a secondary consideration. However, proper design can play an important part in corrosion prevention.

Corrosion is the process by which nature attempts to return a metal to its natural state. For example, unprotected iron in the presence of moist air will convert (corrode) to iron oxide; iron ore (its natural state) is primarily iron oxide.

In cases where metals and alloys with less than optimum corrosion resistance are used, some method of providing additional protection must be used. It then becomes the responsibility of the user to maintain the corrosion protection provided. Such routine actions as proper cleaning, thorough inspection and reporting, and use of proper maintenance procedures can give the Air Force an edge in its battle against corrosion. ★

TECH TOPICS

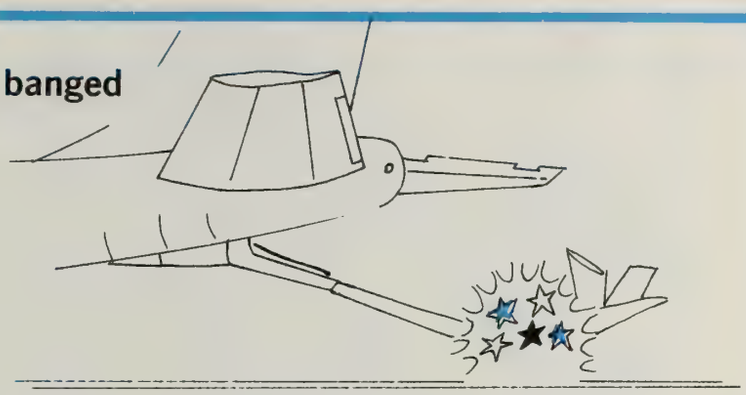
no red cap–red face

After a SOAP lab identified a significant increase in oil iron content from a C-130 engine, they asked for a magnetic plug check but didn't get it. Perhaps they were blaming the guys on the other end . . . until it was discovered that they did not designate a "Red Cap" or code the request per TO 00-20-5.

misplaced foam

During a recent training mission, the loadmaster on a C-130 noticed fuel streaming outboard of nr 1 engine. Troubleshooting after landing revealed that some tank foam was caught between the flapper and seal in the nr 1 tank filler neck, which prevented the flapper from sealing properly.

boom banged



During phase inspection on a KC-135, the refueling boom was to be lowered for inspection. The boom was raised by the hoist handle, and unlatched. The personnel operating the boom began to lower it, moving the hoist handle to the lower position. As the boom reached about zero degrees, the operator attempted to look through the sighting door to observe the boom's position. At a point just prior to the lower detent, the handle was inadvertently slipped into the free-wheel position. The boom fell to the ramp, damaging the tail cone and requiring removal.

Investigation revealed a defective guard assembly which allowed the hoist handle to be inadvertently placed into the free-wheel position. The guard has a lip which was bent so badly it was ineffective. There was no write up in the 781A by flight crew or maintenance personnel stating the guard was defective. Ten other aircraft were checked and four had the same defect. The 781A is an excellent tool, but only when it is used. Also, if the padded aerostand required for this operation had been used, there would have been no damage.

the link that wouldn't shrink

Right after lift-off when the gear handle was raised the left main gear on the F-4C failed to retract. The pilot put the handle back down, reduced weight and made a normal landing. Upon postflight inspection, maintenance found that the left MLG shrink link had failed. Cause: Improper strut servicing. During preflight the pilot noticed that the left MLG strut was low and called the crew chief's attention to it. The crew chief serviced the upper chamber of the strut; the resulting overpressure failed the shrink link during retraction.

This was not an isolated case—there have been several repeats. Ought to be a good topic for your next OMS or FMS meeting.

tool kit check

While performing a test cell run on a TF30-P3, the crew saw sparks coming out of the tailcone just before the engine reached idle speed. The test run was terminated and the engine returned to the shop for teardown inspection. The inspection disclosed that an engine assemblyman had left a cotter key extractor tool in the engine, causing the sparks. Total repair cost was $22,236.

infamous remarks



T-38—lost boatail. All fasteners not secure.

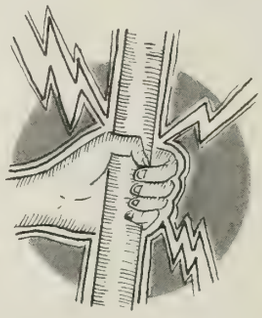
A-7—lost panel. Panel had been removed the day before; however, no 781 entry was made.

How many times have we heard remarks such as these? "It's not my job." "It's shift change time so leave it for next shift." "They can do it in phase inspection." "Those two loose fasteners won't hurt, the other 23 will hold it on."

These remarks frequently precede an aircraft incident.

TECH TOPICS

a fatal mistake



When the young airman and his wife decided to try to improve the TV reception at their 3rd floor apartment in a foreign country, they didn't realize it would cost him his life.

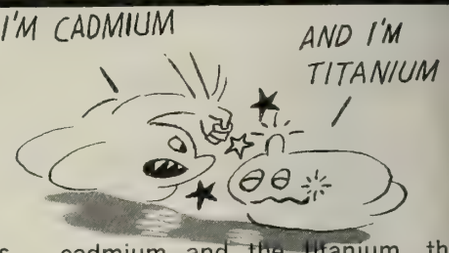
The antenna was fastened to the side of the building and the airman wished to move it to the roof. He cut the support wires and was maneuvering the antenna into the bedroom with his wife holding the bottom of the pole and guiding it into the bedroom from the balcony. The airman was holding the pole in the middle.

The pole struck an uninsulated cable carrying 22,000 volts and the airman took the brunt of the shock, his body acting as a relay transferring arcing and power feedoff to the balcony railing. Death was instantaneous for the airman and his wife received minor burns.

3 engine landing

The pilot was making a ground controlled approach. While advancing the power on the C-130, nr 4 throttle would not move forward, so that engine was shut down. Why did the pilot have to make a three engine landing? An electrical splicer and a 10/32 bolt lodged in the throttle quadrant.

cadmium plated fasteners in titanium structure

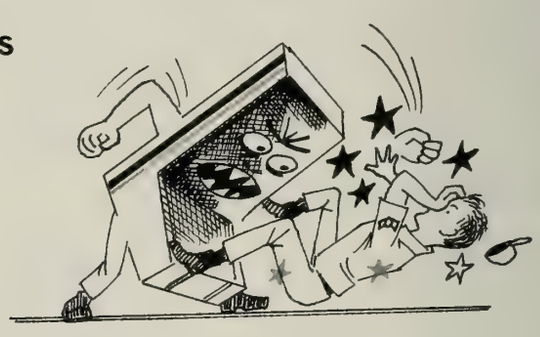


The following, from Lockheed's TriStar Service Digest should be of interest to maintenance personnel.

"Cadmium plated fasteners or washers should not be used to make repairs in titanium structure. Under certain temperature and loading conditions, cadmium chemically attacks titanium, resulting in embrittlement of the material around the fastener hole, which subsequently may lead to cracking. The higher the temperature that the cadmium/titanium interface is subjected to, and the higher the pressure between the cadmium and the titanium, the greater is the probability of embrittlement of the titanium. It appears that a stress alloying condition occurs, wherein the cadmium actually penetrates the titanium and forms a brittle intermetallic. The rate of this process increases with increasing temperature and pressure.

In a low temperature, low stress application cadmium/titanium contact may be acceptable. However, if any doubt exists, it is best to avoid cadmium/titanium contact."

seat sorries



A couple of incidents reinforce that old adage, "You can't take anything for granted." One of the aircraft was an F-4. During post-flight inspection the crew chief was installing safety pins and he discovered that the survival kit forward holddown straps were disconnected. He lifted the survival kit, checking to see if it was loose, and the deployment cartridge fired. Moral: If you aren't **positive,** call a specialist.

The forward cockpit seat was removed from an F-106B. After removal the technician was going to raise the jettison handles for painting. He installed the safety pin and disconnected the M3A2 initiator linkage on both sides. He then proceeded to raise the ejection seat handles and the M3A2 initiator functioned. No doubt, he was shaken by this unexpected event. Let's see what went wrong. The tech did not realize that on an F-106B model forward seat that there is an M3A2 initiator **under** the seat. It too has to be pinned and the linkage disconnected prior to raising the jettison control handles. A look in the book would solve the problem. ★

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Well Done Award

Presented for

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and professional

performance during

hazardous situation

and for a

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to the

ited States Air Force

Accident Prevention

Program.



First Lt WALTER S. RICHARDSON
38 Flying Training Wing
Moody AFB, Georgia

On 19 August 1974, First Lieutenant Walter S. Richardson, Instructor Pilot, was flying a contact training mission in a T-37B aircraft. As the aircraft approached the vertical position in an over-the-top maneuver, a loud explosion was heard from the right engine accompanied by severe engine vibrations and rapidly decreasing right engine rpm. Lieutenant Richardson assumed control of the aircraft. During the recovery to level flight, the right engine fire light illuminated. When the engine was shut down heavy smoke began filling the cockpit, but a visual check failed to confirm fire. An immediate return to home base was initiated. Lieutenant Richardson executed an excellent modified single engine straight-in approach and landing opposite the direction of traffic. The aircraft had inducer rotor blade failure which destroyed the engine and caused internal engine fire, allowing smoke and fumes to enter the cockpit.

The exceptional skill and decisive action on the part of Lieutenant Richardson averted the loss of a valuable aircraft and possible crew injury. WELL DONE! ★

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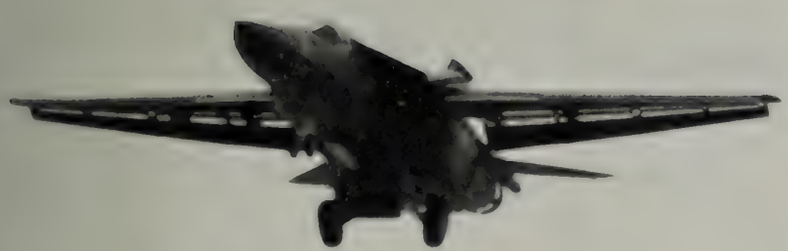

Get it...
together!!!
That's what Debbie Hagu
22 and 5'8" is doing
with her U.S. Coast Gua
approved life vest.
For the whole thing, see
"Water Sports," page fo

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Y5

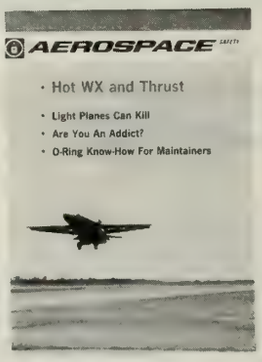
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JULY 1975 AFRP 127-2 VOLUME 31 NUMBER 7

THE IFC APPROACH

By the USAF Instrument Flight Center, Randolph AFB, Texas 78148

Q: When must a SID show a minimum climb rate table?

A: If a SID requires a climb of 150 feet per NM or less, rate of climb information is not required. A rate of climb above 150 feet per NM will be shown (in graphic form) on the SID as a minimum rate of climb. A climb gradient of more than 300 feet per NM is not authorized without a waiver and an appropriate warning to the pilot printed on the SID.

Q: I am being vectored away from a previously assigned SID; will the altitude restrictions published on the SID still apply?

A: An altitude restriction associated with a specific fix is only applicable at that specific point, but an altitude restriction associated with a radial is applicable anywhere the aircraft flight track crosses that radial. If it is not clear—ASK!

Q: Does ATC expect a minimum climb rate or descent rate when an aircraft is cleared for a new enroute altitude?

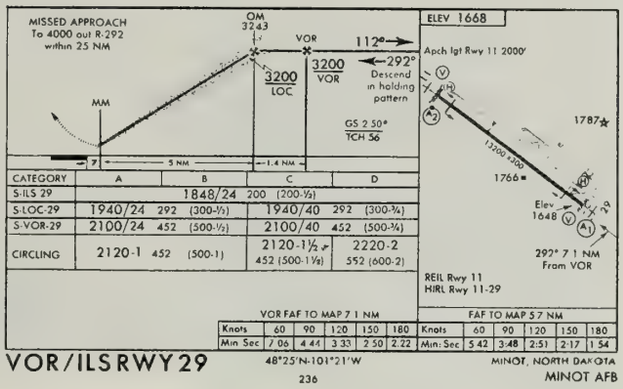
A: This is addressed only when minimum climb rates associated with Minimum Crossing Altitudes (MCA) are required. MCAs are based on the following climb rates:

Sea Level through 5000'	— 150' per NM
5000' through 10,000'	— 120' per NM
10,000 and above	— 100' per NM

Q: Am I required to keep the runway in sight while circling to land?

A: AFM 51-37 requires the pilot to have the runway environment in sight after descending to the circling minimum descent altitude. The runway environment is that area associated with the runway such as approach lights, overrun area, taxiways, and aprons. The airfield diagram provides the most accurate information about the runway environment.

Q: I can see that the missed approach point (MAP) for the ILS on this approach is very close to the middle marker but where is the MAP for a VOR approach?



A: The timing block indicates that the distance from the VOR final approach fix to the missed approach point is 7.1 NM. This would put the VOR MAP at the approach end of the runway. Remember that the MAP for a precision approach (GCA/ILS) is at decision height (DH).

POINT TO PONDER

ASR Approaches at FAA-Serviced Airports

A published ASR approach procedure may not always be approved when requested. This is particularly true of airports that are served exclusively by the FAA. An ASR approach requires a controller to devote his entire attention to the single aircraft performing the approach. It also requires the radar scope to be set on a limited range to provide the best accuracy. Therefore, an ASR approach requires additional equipment and controller staffing beyond that required to provide routine ATC services. If a situation presents itself that requires special or emergency handling and an ASR approach is necessary, positions of operation and controller duties may be combined to provide the approach. Normally, the approval of a pilot request for an ASR approach would be based on traffic activity and/or the availability of a separate controller and radar scope. It is not practical to issue NOTAM information to advise pilots when ASR approaches would not be approved at specific locations. Plan to use non-radar instrument approach procedures when they are available. ★

HOT WEATHER & THRUST REQUIRED



The hot summer sun beats through the canopy of the T-38 as the student maneuvers into position for takeoff. The runway temperature is already above the 100-degree mark and climbing. He wipes the sweat from his eyes and starts the line-up checklist. The engines are operating normally and the afterburners light almost simultaneously. The RSU controller watches the aircraft roll more than half the runway before lift-off. The temperature and pressure altitude are unusually high today.

Just as he turns his attention to the next aircraft for departure, he hears over the radio, "BARKEY 21 has a fire in the right engine. I've shut it down." Now the well trained RSU crew quickly swings into action to assist the solo T-38 student in coping with his emergency.

After the proper emergency procedures are completed, the aircraft is established on final approach about 10 miles from the field. The controller reviews single-engine procedures with the student. Everything seems normal. The student is fairly experienced in the T-38 and is familiar with the proper single-engine landing procedures.

The controller watches as the aircraft reaches 2½ miles and starts down the glide path. The rate of descent seems excessive so the controller advises the student to reduce it. As he watches, the student goes below the recommended glide path. The controller again directs corrective action. Finally, it is evident that the student is too low; the controller tells him to "go burner" on the good engine. This corrects the high sink rate but not soon enough to prevent the student from touching down in the overrun 500 feet short of the runway.

Most modern military fighter/trainer aircraft have sufficient power to overcome almost any situation. Single-engine operation is not normally a big problem. However, when summer comes this can change. High density altitudes and temperatures mean a *serious* reduction in performance. This reduction is best demonstrated by looking at the thrust available/thrust required curve in the dash 1. In Figure 1, there is an example of a basic thrust available/required curve. While the thrust available with both engines operating (the dashed line) is well above required thrust up to high airspeeds, this excess is significantly reduced during single engine operation. This difference is shown by the two vertical arrows marked excess thrust. As long as your position on the solid line, indicating thrust required, does not exceed the horizontal thrust available curve, you have sufficient thrust to at least maintain level flight.

However, thrust required is a function of airspeed. Notice that, as speed decreases, so does thrust required until a certain airspeed is reached. This speed differs according to aircraft, but it is the most efficient speed from a thrust point of view for that aircraft. This speed is known as best endurance speed. Any other speed—higher or lower—

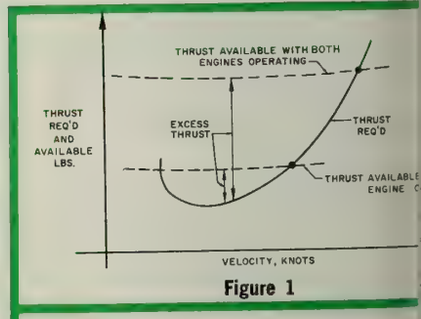


Figure 1

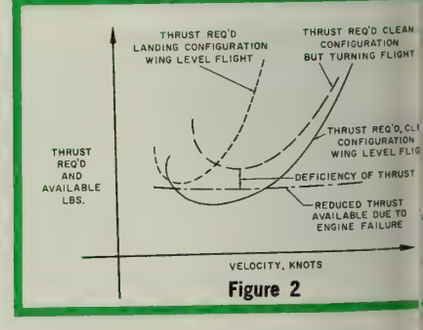


Figure 2

equires more thrust. When operating at a speed below best endurance, ou are operating in what is alled the region of reverse command. That is, in order to maintain a lower airspeed, the pilot must se more thrust. For many aircraft, ormal approach speeds are well ithin the region of reverse command. If both engines are operating, ne thrust available far exceeds that equired in this region. But, when perating single engine, the situation far different. Notice in Figure 1 nat the excess thrust single-engine minimal. This thrust is predicated n level 1G flight. Any bank angle r g-loading will decrease the argin, and in some cases thrust equired will exceed thrust available s shown in Figure 2.

So far, we have only discussed rust available and required in lation to the aircraft speed and loading. Several other factors e critical. Gross weight, configuration, density altitude and mperature all have an effect on rust required. Figure 3 shows the ngle-engine thrust required/available curve from the T-38 dash 1. otice that as temperature or gross eight go up, the thrust available excess of required goes down. If ou use the situation at the beginng of this article where the gross weight is about 11,000 pounds and the OAT is 100 degrees F, you will see that the pilot could not maintain level flight at mil power because the thrust required far exceeded that available. Because of this deficiency, the pilot could not maintain his desired glide path and airspeed. He increased his rate of descent rather than initiating AB and as a result landed short. His only options in this situation were: reduce his gross weight (not a particularly good one here) or maintain altitude and/or glide path by use of AB.

A good understanding of the thrust available/required curve for his airplane will be valuable for a pilot. Not only will it help him understand the best endurance speeds, but when thrust is critical, it could prevent an error in judgment which might lead to an accident. This is true even for the pilot of a multi-engine bomber or transport. Even with four or more engines, a loss of some portion of your thrust available can, under the right circumstances, become a critical situation.

The material for this article was adapted from material published by Northrop Corporation in the Talon Service News. ★

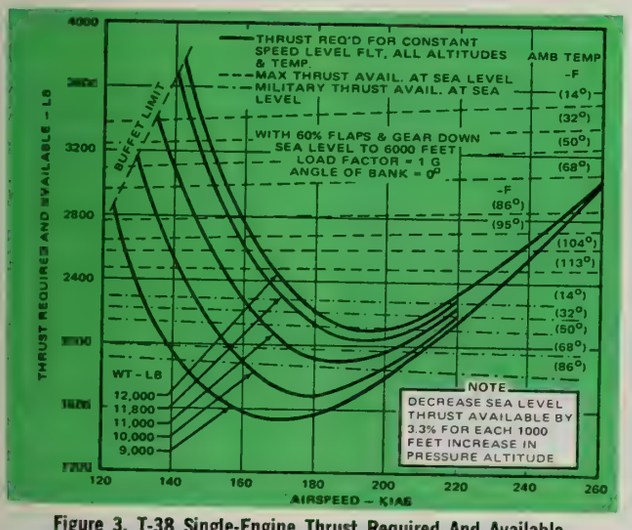


Figure 3. T-38 Single-Engine Thrust Required And Available

THE

REX RILEY
Transient Services Awar

POPE AFB
Fayetteville, North Carolina

TINKER AFB
Oklahoma City, Oklahoma

LORING AFB	Limestone, ME
McCLELLAN AFB	Sacramento, CA
MAXWELL AFB	Montgomery, AL
SCOTT AFB	Belleville, IL
McCHORD AFB	Tacoma, WA
MYRTLE BEACH AFB	Myrtle Beach, SC
EGLIN AFB	Valparaiso, FL
MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
MARCH AFB	Riverside, CA
GRISSOM AFB	Peru, IN
CANNON AFB	Clovis, NM
LUKE AFB	Phoenix, AZ
RANDOLPH AFB	San Antonio, TX
ROBINS AFB	Warner Robins, GA
HILL AFB	Ogden, UT
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, NC
ENGLAND AFB	Alexandria, LA
KADENA AB	Okinawa
ELMENDORF AFB	Anchorage, AL
PETERSON FIELD	Colorado Springs, CO
RAMSTEIN AB	Germany
SHAW AFB	Sumter, SC
LITTLE ROCK AFB	Jacksonville, AR
TORREJON AB	Spain
TYNDALL AFB	Panama City, FL
OFFUTT AFB	Omaha, NE
McCONNELL AFB	Wichita, KS
NORTON AFB	San Bernardino, CA
BARKSDALE AFB	Shreveport, LA
KIRTLAND AFB	Albuquerque, NM
BUCKLEY ANG BASE	Aurora, CO
RICHARDS-GEBAUR AFB	Grandview, MO
RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH
CARSWELL AFB	Ft. Worth, TX
HOMESTEAD AFB	Homestead, FL



losses in private flying

LT COL OWEN A. HEETER
Directorate of Aerospace Safety

During the past five years, private aircraft accidents (non-aero club) have taken the lives of 51 USAF personnel and injured 31 others. Fourteen deaths and five injuries were incurred in 1974 alone. In addition, more than 20 friends or loved ones were also killed during just the past two years. In the first three months of 1975, we lost 4 of our people! Shocking? You bet! But numbers and cost to the Air Force for such losses do not describe the suffering, heartbreak, and tragic loss of the young productive lives.

During 1973 and 74 there were 29 private aircraft accidents involving USAF personnel and in 19 of these there were fatalities. Seventeen of the 19 were caused by operator error. Let's look at the accidents from the past two years to try and determine "why."

Six accidents were caused by pilots losing control at low altitude and allowing the aircraft to enter a stall or spin. In all cases the weather was good but the pilots used poor judgment by performing maneuvers beyond their or the aircraft's capability. Combine these maneuvers with low altitude, where the margin for error is reduced to practically zero, and an accident is almost always assured.

One low altitude stall and crash occurred when the pilot attempted a buzz-job on a friend's house. The pilot was tired and had been drinking!

Three accidents happened right after takeoff when the pilots stalled their aircraft immediately following an engine failure. These pilots violated a basic rule for handling any emergency—*maintain control of the aircraft.*

Bad weather was an ingredient in four accidents:

- A pilot on a cross country flight in mountainous terrain hadn bothered to check the weather. I his attempt to remain above th weather he crashed into a moun tain. No planning and poor judg ment cost the pilot his life an caused permanent injury to his wif
- A pilot took off at night wit

no flight plan in forecasted low ceilngs, snow showers, and icing. He it a hill while trying to stay under he weather!

• A pilot attempted a takeoff in ow visibility and fog with frost and now on the wings and the aircraft verloaded. The aircraft stalled on akeoff. Scratch another pilot beause of poor judgment.

• A pilot took off with a low eiling due to fog. He entered the og and was next seen as the airraft came spinning out of the fog ayer. His family perished with him.

One pilot took off for a night leasure ride with his wife and nother couple. The only problem as that he had no night or instruent training or experience. The ircraft crashed shortly after takeff, killing all aboard.

Poor judgment and a lack of ommon sense were evident in all e accidents.

Although the total time of the ilots involved ranged from over 000 to less than 65 hours, every ccident was caused by the pilot noring or violating a basic prinple of flying. To do something ght, one must thoroughly know nd properly apply the basics every me! In ten of the above fatal accients the pilots had less than 100 ours in the particular aircraft beg flown, one as low as two hours. ad they learned their basics well ough? Had they learned the peliar characteristics of the aircraft ing flown? If so, then one can ly assume that the basics were t applied. Beware of any comnation of inexperience, poor judgent, and over-confidence for sure- nothing good will come of it!

Well, you say this philosophy bit all well and good, but what can do? One area where considerable nefits can be derived is participan in and support of Air Force ro clubs. The accident rate for ir aero clubs is much better than at of general aviation (Fig 1). uring the past five years while 51

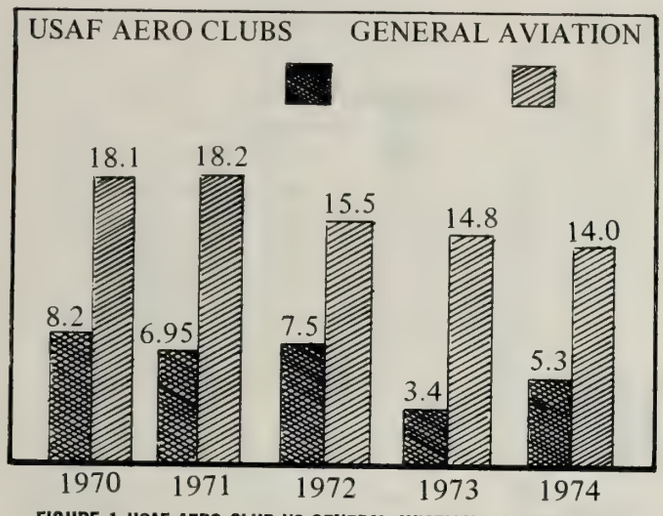


FIGURE 1 USAF AERO CLUB VS GENERAL AVIATION ACCIDENT RATES

USAF personnel were killed in non-USAF private aircraft accidents, 21—less than half as many—died in aero club accidents. In the past three years there have been only four aero club fatalities.

The aero clubs have well-maintained equipment and provide excellent guidance and the necessary control for students and pilots with limited experience—yet, the pleasures of flying are still retained. In private flying nearly every serious accident involves some degree of lack of experience/training and poor judgment. Certainly those involving USAF personnel, for which we have records, reflect these factors.

If you are a supervisor it may be worthwhile to have the local aero club manager talk to your people who fly or go to him and get the details of the program. Commanders and supervisors should learn about private flying, identify those individuals who engage in it and then keep in touch with their progress. Show the interest and provide the necessary counseling and guidance. The rewards will far surpass the effort. ★



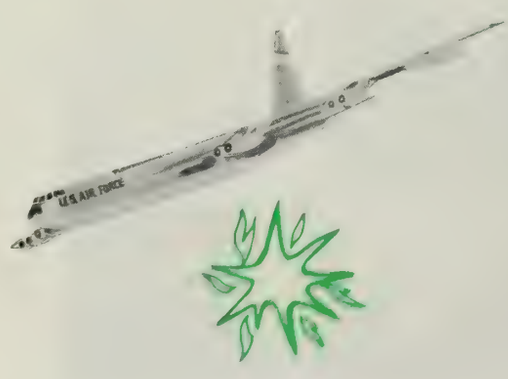
Fifty-one USAF personnel have died in general aviation (non Aero Club) aircraft accidents during past five years. Most accidents resulted from operator error.

HOT CARGO

MAJOR THOMAS R. ALLOCCA
Directorate of Aerospace Safety







The young major is assigned as an action officer, J-1, office of the Joint Chiefs of Staff at the Pentagon. One weekend per month he flies a T-39 from Andrews, making passenger trips to Scott or McGuire. On this particular weekend, he's ferrying two containers of a caustic substance from Andrews to Charleston.

The flight proceeds without event until an engine fire necessitates an emergency landing at Norfolk NAS, Virginia. He lands safely and is proud of his handling of a serious inflight emergency, until the director of airfield management advises him he's violated several of the provisos of AFR 55-14.

The point is: we have a pretty good track record for transporting cargo that requires special handling; however, the vast majority of this transporting is done by those who have been thoroughly trained and briefed on all appropriate procedures and regulations. Furthermore, they routinely do this . . . It's their job.

But consider the case of the F-4 pilot who's out on the range to drop a few practice bombs, and, in the course of his maneuvers, an emergency develops requiring an immediate diversion to the nearest suitable base. He hasn't gotten rid of all munitions aboard, jettisoning is out of the question, and now he has to land at McCarran Field. He too has some 55-14 provisos to consider before landing at McCarran.

Then there's the B-52 crew from K. I. Sawyer on their way to the Matagorda Range to drop some iron bombs. Equipment malfunctions precluded the release of all stores, so they're returning to Michigan with a couple of hung bombs when they get the word that they'll have to weather divert into Robins Air Force Base. Again, AFR 55-14 requires that the crew notify appropriate aerodrome personnel prior to landing.

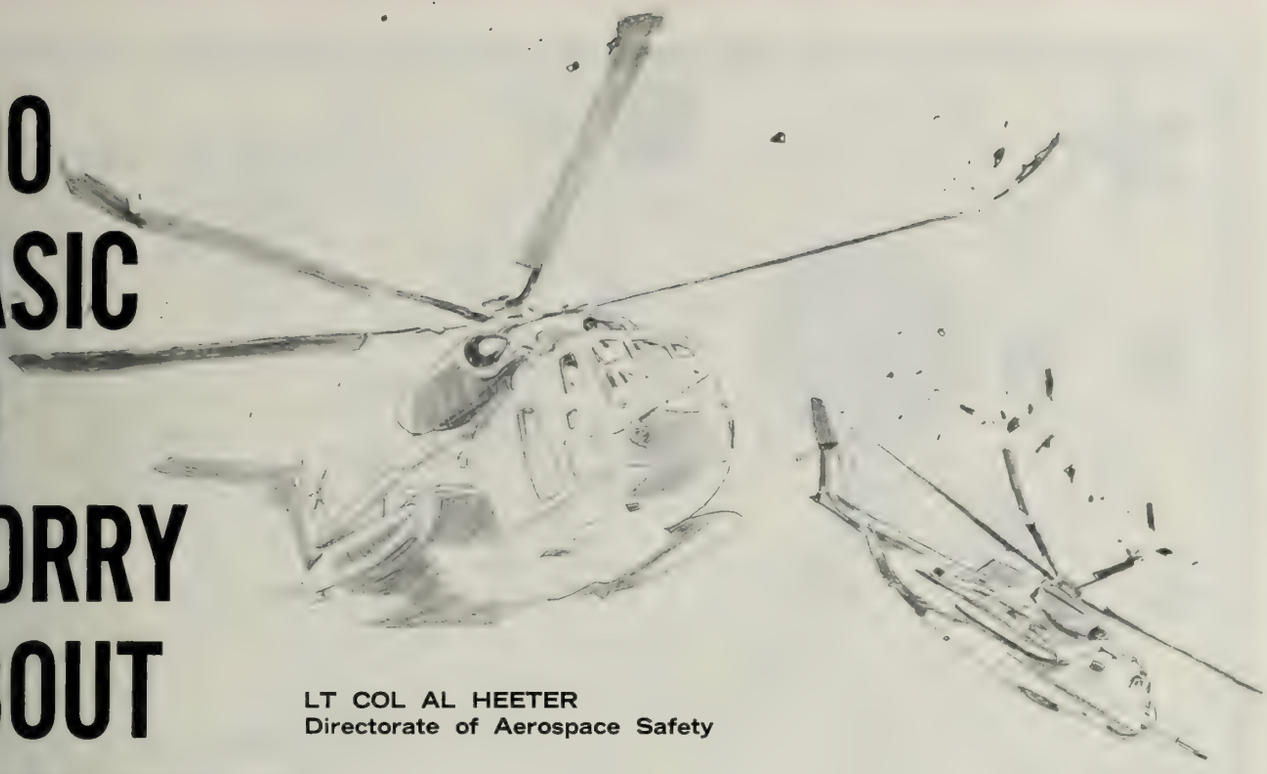
These examples are cited merely to point out this fact: Regardless of the command you're assigned to, regardless of the aircraft you're flying, regardless of the nature of your mission, you can very easily find yourself in a situation where the requirements of AFR 55-14 must be satisfied—by you!

Briefly stated, AFR 55-14 establishes triservice policy and procedures for alerting base support elements to the arrival or departure of aircraft carrying "dangerous materials." And those "dangerous materials" are not necessarily limited to bombs or exotic mixtures. No, they are defined as any material that is flammable, corrosive, an oxidizing agent,, explosive, toxic, radioactive, nuclear, unduly magnetic, or biologically infective or any other material that, because of its quantity, properties or packaging, may endanger human life or property.

Yes, you're right, the list is exhaustive and all-inclusive, which serves as a further reminder that sometime during your "aircrewing" days, 55-14 is going to affect you.

Your parent command has probably published some explicit directives regarding instances very similar to those mentioned earlier. And it behooves you to become intimately acquainted with these directives, plans and orders. But it also behooves you to become pretty familiar with the requirements of AFR 55-14, lest you wind up in a situation much like our friend from the Pentagon. While you're patting yourself on the back for a job well done someone else may be "patting" you on a different part of your exterior for a job poorly done.

TOO BASIC TO WORRY ABOUT



LT COL AL HEETER
Directorate of Aerospace Safety

"Everybody knows that, don't worry about it. That's basic knowledge, let's get on with the important things."

Familiar words, aren't they? Some of the things we do in flying or maintaining our aircraft are so basic that, unless we think about them they are overlooked. But, of course, that's why we have checklists, tech orders, standardization, quality control, etc. Let's take a look at some examples of the point I'm trying to make.

Two H-53s from a sister service were on a TAC profile mission which included formation. While in a climb, the formation leader signaled for a lead change and continued flying and looking straight ahead. The new lead, thinking he was now in charge of the formation, also flew straight ahead and diverted his attention from the lead to straight ahead. With neither pilot watching the other aircraft, separation diminished until the main rotors of the two aircraft came in contact. Catastrophic break up of one aircraft occurred immediately, and the pilot of the other managed a forced landing on a ridge.

The formation training backgrounds of the two pilots at the controls (one Army—one Navy) stressed different procedures for formation lead change. Both were expecting the other to maneuver to the new position. Was something very basic overlooked? Although the sequence of formation maneuvers was briefed, the detailed execution of each formation maneuver was not discussed. "This was considered to be basic knowledge of all aviators."

An H-3 crew attempted flight from a remote area in weather conditions which did not provide adequate visual reference with the ground. The pilot became disoriented during the hover and allowed the aircraft to accelerate backwards into the side of a hill. Is it too basic to ensure adequate conditions exist prior to attempting flight?

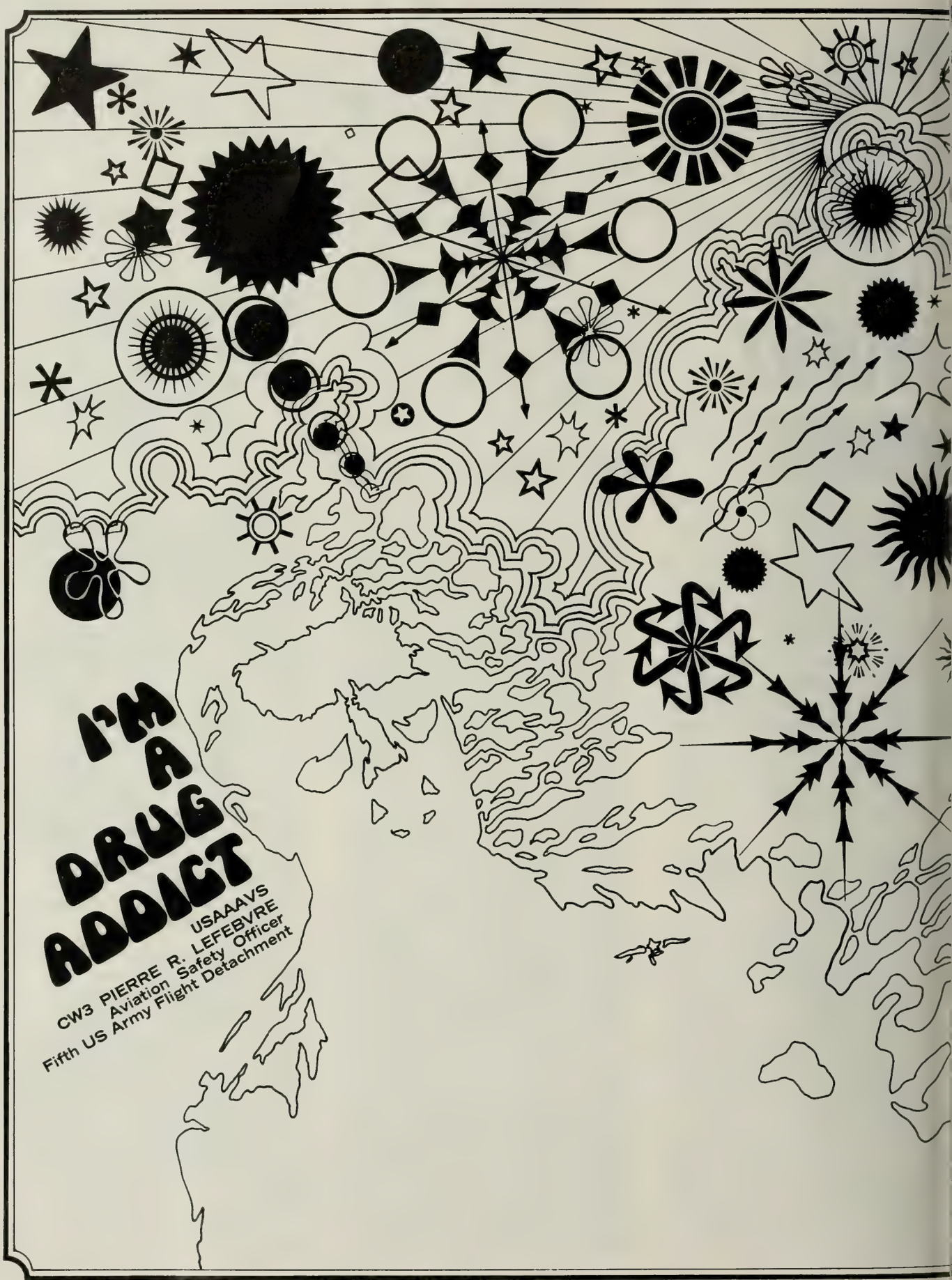
A helicopter technician improperly adjusted a valve, performed improper checks of the system and entirely omitted other checks—all of which were outlined in the tech order. The aircraft later took off, had control problems and crashed. Is it too basic to worry about what the TO says, since you already know what has to be done?

A non-self retaining bolt was found in a control rod where only self retaining bolts were authorized. This situation has caused several accidents. Is it too basic to worry about whether the proper bolt is installed in a control rod? After all, that is nothing but good basic maintenance!

Isn't it sound procedure and good reaction in an H-53, when you see one engine at zero torque but still running and the other engine at or near topping, to assume Nf flex shaft failure and to immediately retard the engine with the high torque? Think again! Such foolhardy omission of basics has actually caused accidents.

I could go on and on with examples, but no matter how you cut the cake there is nothing in aircraft operations too basic to worry about. Everything goes back to basics. Just as the pro golfer worries about his basic grip and stance, the pilot and the maintenance man must worry about—and continually go back to—the basics of operating and maintaining an aircraft.

NOTHING is "too basic to worry about!" ★



I'M A DRUG ADDICT

CW3 PIERRE R. LEFEBVRE USAAAVS
Aviation Safety Officer
Fifth US Army Flight Detachment

Good morning, gentlemen! Welcome to the ninth installment of Pierre's Safety Class. This morning, we will talk about pilots and other strangers. The other strangers we'll talk about are depicted on the wall in front of you—the crew chief, the ASO, the commander, the typical W4, etc.

But first, I have something of extreme importance that I must say. It is a confession of sorts, an admission of guilt, whatever. I feel that you guys should know, because you are my fellow aviators and friends. This is a problem I've had for a long time. I did a lot of soul-searching before I was able to admit it to myself, let alone admit it to anyone else. You see, I'm a drug addict.

Now, before you jump up and call the Half Way House or the MPs, or FEB me, let me tell you how I got hooked on the stuff so you can possibly help your children and prevent their addiction to drugs.

It started for me when I was 19 years old, just before I came into the Army. I was working in a factory in Nashua, NH, and because of my age, I was known as the "Kid." Hey Kid, do this; hey Kid, do that. Acceptance by your peer group is a basic fundamental in the hierarchy of man. Use of drugs in that factory was everywhere, so in order to gain acceptance with my fellow workers, I tried the liquid additives. I didn't like them at first, but my tolerance built up rather fast. But more important, acceptance was starting to come my way. I was almost a part of the group. Well, through a little prodding and pushing, they got me to try the inhalant drugs. That was terrible. You see, I didn't smoke.

In order to gain the full acceptance of the group, I continued with drugs and eventually became hooked. That was the way to acceptance, being hooked. I didn't, at that time, realize the harmful effects these drugs would have on my body. The drugs were very easy to get. You could buy them on just about every corner in town.

When I went into the Army a short while later I started to have a hard time getting my drugs. Again I wasn't in the clique or in the group. Once I found the right people and made friends with them, I had no problems getting my drugs. Well, that was basic training.

In flight school, I got the drugs, but not enough of them. There was never enough because of the busy schedule. I graduated from flight school and was an officer going to Vietnam with plenty of money in my jeans. Everyone knows about the drug problem in Vietnam. I was in seventh heaven! I could get my drugs any time I wanted.

Fortunately, if you can call it fortunate, I never graduated to the hard stuff in Vietnam. You see, the peer group regulated me. To use hard stuff, you were out of the group. My fellow aviators and friends all used the additives and inhalants, but they would not touch opium or heroin. What are my drugs? They are caffeine and nicotine.

Caffeine—what does it do to you? Caffeine, one of a class of chemicals known as the xanthines, is still prescribed occasionally by physicians. Xanthines can, in varying degrees, cause central nervous system stimulation and cardiac stimulation. They also act as mild diuretics. Combined with other drugs, caffeine is sometimes used for headaches, particularly migraine, and in some "pain remedies," for example, APC tablets. Nonmedically, caffeine is the most widely used central nervous system stimulant, popular in the form of coffee, tea, cocoa and cola drinks. Heavy users of these beverages report tolerance, physical dependence with withdrawal symptoms and craving.

Yet caffeine can be a dangerous drug. The desired effects are remarkably similar to those of cocaine and amphetamines.

Caffeine stimulates all portions of the cerebral cortex. Its main action is to produce a more rapid and clearer flow of thought, and to delay drowsiness and fatigue. After taking caffeine, one is capable of a greater sustained intellectual effort and a more perfect association of ideas. There is also a keener appreciation of sensory stimuli, and reaction time to these stimuli is greatly reduced. This accounts for the hypertension, sometimes unpleasant, which some people experience after drinking too much coffee. In addition, motor activity is increased. Typists, for example, work faster and with fewer errors. However, this is where flying comes in. Acquired motor skills in a task involving delicate muscular coordination and accurate timing may be adversely affected. These adverse effects may be brought on by the administration of 150 to 200 milligrams of caffeine, the amount in one or two cups of coffee or tea.

In addition to its effect on the cerebral cortex and other portions of the central nervous system, caffeine in modest doses (a few cups of coffee or tea) affects the heart rate, heart rhythm, blood vessel diameter, coronary circulation, blood pressure, urine production and other physiological functions.

Coffee also has a marked effect on the human metabolic rate. Numerous investigators have reported that the ingestion of 0.5 grams of caffeine (three to four cups of coffee) may increase the metabolic

rate an average of 10 percent and occasionally 25 percent.

Is caffeine addicting? Opinions vary, depending on one's definition of addiction. One feature of heroin addiction is tolerance, the gradual fading effects as the same dose is taken daily. An appreciable degree of tolerance may develop to certain effects of the xanthines, especially the diuretic and vasodilator actions. Cross-tolerance between the members of the group also occurs as it does among the various narcotics.

Another feature of heroin addiction is the withdrawal syndrome or physical dependence. Caffeine unquestionably produces withdrawal effects at certain dosage levels. There is no doubt that the excitation of the central nervous system produced by some amounts of caffeine is followed by depression. Research has shown that physical dependence does occur on five or more cups of coffee a day.

When taken in very large doses, caffeine is a potent poison. A fatal dose of caffeine given to an animal produces convulsions because of the central nervous system stimulating effect. Early in the poisoning, these convulsions are epileptiform in nature. In the final stages of the poisoning, death will occur from a respiratory failure. The fatal caffeine dose in man is estimated at 10 grams (70 to 100 cups of coffee or an average of four cups of coffee an hour every hour for the normal 18-hour awake period).

In animal experimentation, when we check out the behavioral effect caused by large doses of caffeine, even more shocking findings may be noted. Several research teams have reported, for example, that rats fed massive doses of caffeine become aggressive and launch physical attacks against other rats. More remarkable still, a caffeine-crazed rat may bite and mutilate himself. This mutilation was so acute and intense in some rats that these animals died from loss of blood.

Some of you may be moved to protest that the bizarre behavior of rats fed these massive doses of caffeine is irrelevant to the problems of human coffee drinkers. I agree 100 percent. However, there is a lesson to be learned from these rat reports. If the drug producing these effects in rats were marijuana, or LSD, or amphetamines, the report would be worthy of banner headlines on every newspaper in the country.

Now, let's talk about the effects of nicotine. Taken in the form of cigarettes, cigars, pipe and chewing tobacco, and snuff, its effects are variable. It can act as a stimulant, depressant or tranquilizer. Tobacco is one of the most physiologically damaging substances used by man.

Tobacco is a factor in cancer, coronary artery disease, emphysema of the lungs and other diseases. Since nicotine is one of the most addicting drugs in common use, most tobacco users are "hooked" and, as a result, locked to the damaging effects of the tobacco. At present, there is no known lethal dosage that can be administered through smoking.

The first modern scientific evidence that nicotine is addicting appeared in an English journal in 1942. Dr. Lennox Johnson reported that he had given small injections of nicotine solution to 35 volunteers, including himself. "Smokers almost invariably thought the sensation pleasant," and given in an adequate dose, were disinclined to smoke for a time thereafter. After 80 injections of nicotine, an injection was preferred to a cigarette. If the nicotine injections were abruptly discontinued, craving arose. A one-milligram injection of nicotine is roughly equivalent to smoking one cigarette. Dr. Johnson concluded that "smoking tobacco is essentially a means of administering nicotine, just as smoking opium is a means of administering morphine."

If it were not for the nicotine in tobacco smoke, people would be little more inclined to smoke cigarettes than they are to blow bubbles or light sparklers.

A certain level of nicotine in the brain is crucial for the dependent smoker. On the basis of studies, it is probable that nicotine is present in the brain within a minute or two after starting a cigarette, but 20 to 30 minutes after completing the cigarette, most of the nicotine has left the brain for other organs (e.g., liver, kidneys, stomach). This is just about the period when the dependent smoker needs another cigarette. The smoking pattern of the dependent smoker who inhales a cigarette every 30 minutes of his waking life (a pack and one-half a day) is such as to ensure the maintenance of a high level of nicotine in his brain.

Now just a word about the ease with which one can quit smoking. With most drugs, you get over the withdrawal symptoms in a few days, a week at most. But with tobacco, symptoms have been noted for six months and longer.

I'm not on a band wagon trying to stop all smoking and coffee drinking. Far from it. I drink coffee, perhaps too much, and I also smoke, perhaps too much again. All I'm trying to do is let you in on a few facts about legalized domesticated drug addiction and the effects of overindulgence. My facts came from a book entitled "Licit and Illicit Drugs" by Edward M. Brecher.

I must go now. It's been 30 minutes since my last cigarette and a cup of coffee sounds good. ★



It's not the heat... IT'S THE HUMIDITY

DANER R. REIDER
Major, USAF, MC
Directorate of Aerospace Safety

Air Force flightlines get to be about as hot as anyplace in this world during the high temperature summer months. All that concrete bounces back a lot of the sun's heat. And aircraft become like furnaces. The temperatures experienced by our people working there can be hazardous. But a little knowledge about how the body handles heat and the things a person can do for himself can prevent damage to the individual.

Most of us have heard the common cliché used as a title here when referring to summer weather. The simplicity of the expression is misleading, however, and doesn't help us too much in preparing ourselves for thermal stress. Because USAF operations are worldwide, the "summer" season presents different problems depending on the geographic location of the base. Consequently, any discussion of thermal stress must be general and contain guidelines that can be adapted to each locale. We hope this article will do just that.

BASIC FACTS

Let's begin by listing some facts about temperature and the human body:

- The normal temperature range is 96.6°F (35.8°C) to 100.0°F (37.8°C) with the average of 98.6°F (37.0°C); we are warm-blooded (hemeothermic).
- The minimum temperature occurs at 3-5 AM in the morning and the maximum occurs in late afternoon or early evening.
- The skin temperature can vary widely and is lower than that of the internal organs.
- Muscular exercise can raise body temperature 1-4°F or more.
- With physical exertion, more than 75% of the increased metabolism appears as heat, the remainder is useful external work.
- The range of heat regulation is 79.5°F (26°C) to 110°F (43°C) and exceeding these extremes will cause death from cardiac failure and loss of nervous system control of body temperature.
- Heat produced must equal heat lost.
- The heat production of the average man doing light work is 3,000 calories; he will lose 3,000 calories of heat at room temperature in the manner shown in figure 1.

THERMAL REGULATION

Since several words have been in-

FIGURE 1

	Calories	%
A. Radiation, convection, conduction	1,950	65
B. Evaporation of water from skin and lungs, and liberation of carbon dioxide	900	30
C. Warming inspired air	90	3
D. Urine and feces (heat of these waste products over that of food and water)	60	2
	3,000	100

Scott, J. W.: Chapter 52, "The Body Temperature." In: *The Physiological Basis of Medical Practice*, C. H. Best & N. B. Taylor (Editors), Baltimore, The Williams & Wilkins Co., 1961.

troduced concerning heat loss, it is necessary to discuss how the body regulates its temperature so effectively and generally without conscious effort.

The table shows that 95% of the body's heat loss is accomplished by radiation, convection, conduction, and evaporation. For the purpose of this article, the other methods will not be discussed because of their insignificance. Furthermore, since air is a poor conductor of heat, loss of heat by conduction is rarely important unless the body is in direct contact with an object, such as water. Thus the following discussion will focus on radiation, convection, and evaporation.

RADIATION

Definition: the transfer of heat by radiant energy through space in the direction of diminishing temperature gradient; i.e., heat will travel from a hotter to a colder object.

Facts:

- The greater the temperature difference, the greater and more rapid the heat loss.
- The greater the body area exposed, the greater the heat loss when environmental temperatures are lower than body temperature.
- By reflecting radiation, proper clothing can diminish absorption of heat by 60 cal/hour.
- The main factor influencing heat loss by radiation is the temperature gradient.
- Because air with a high water vapor content is more opaque to radiant heat, heat loss by radiation is SLIGHTLY reduced by high relative humidity.

The body controls heat loss by radiation through the autonomic nervous system (involuntary control). Essentially, from 59°F (15°C) up to body temperature, the blood flow is redistributed to bring more blood to the skin as the ambient temperature rises. In addition, the blood flows faster and the blood volume will increase by taking water from the cells of muscles, the liver, and the skin.

CONVECTION

Definition: The transfer of heat when a liquid or gas comes in contact with a heat source, is heated, then expands and rises as it is displaced by heavier, cooler liquid or gas.

Facts:

- Heat loss by convection depends on the relative densities of air at different temperatures; i.e., warmer and lighter air rises and the cooler air falls.
- Convective heat increases with the square of wind velocity up to 60 mph, with little or no change beyond that velocity.
- Convection is increased by low air temperature and body movement.

The control of heat loss by convection is essentially the same as that for radiation.

EVAPORATION

Definition: The transfer of heat by the secretion and drying of sweat and the exhalation of water vapor from the lungs.

Facts:

- Evaporation begins to assist in heat loss when the environmental temperature reaches 82-84.5°F (28-30°C) and above 95°F (35°C) accounts for nearly all heat loss.
- At 98.6°F (37°C), there is no heat loss by radiation or convection and the body would gain heat without the mechanism of evaporative heat loss.
- The rate of evaporation decreases when the relative humidity is high.
- Sweat dripping off the body is useless as a heat loss mechanism because the sweat must dry to be effective.

The relationship between environmental temperature and humidity is shown in figure 2. If the air were perfectly dry and an individual drank enough H_2O and wore minimal clothing, he could survive very high temperatures, assuming he was at rest. As the humidity increases, however, the graph shows how the tolerance will decrease so that an air temperature of only 90°F (32.2°C) is unbearable for an extended period. Air movement will assist evaporation because the layer of saturated air next to the skin is replaced by drier air.

WHAT IS SWEAT?

Sweat is a weak solution of salt (NaCl) in water. The salt can vary from 0.2-0.5%. With profuse sweating in an unacclimatized person, the percentage of salt is high, but decreases with acclimatization. The autonomic nervous system controls the amount of sweat secreted, and

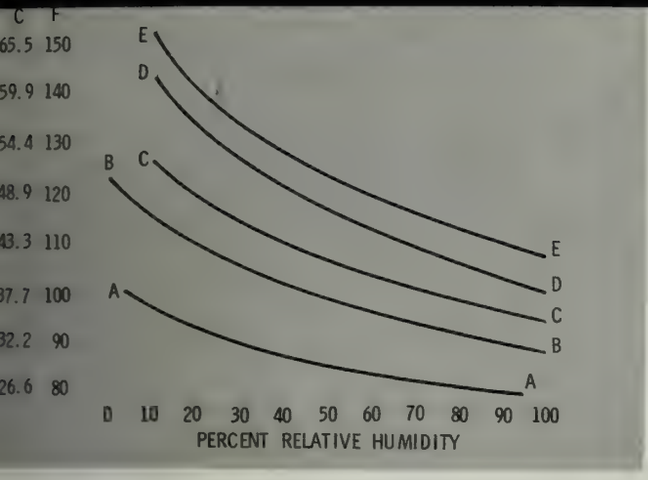


FIG. 2. RELATIONSHIP OF TEMPERATURE—HUMIDITY EFFECT. The limiting environments of temperature and humidity for human tolerance, employing criteria which range from easy to difficult: AA, the upper limits of summer comfort zone; BB, the limits of evaporative cooling, with little or no rise in body temperature; CC, the limits of compensated hyperthermia; DD, 60-minute tolerance limit; and EE, 30-minute tolerance limit. (Winslow, Herington and Gagge; Robinson, Turrell and Gerking.)

From: AFP 161-18, 27 Dec 68, Flight Surgeon's Guide P. 5-H

the main and most important stimulus is the rise in body temperature on the nerve centers in the brain.

Facts:

- Sweating commences when the air temperature is 80-90°F (27-32°C).
- Sweat loss may reach 2-3 liters/hour in strong subjects working in heat.
- Although sweating is not dependent on circulation, it usually is associated with vasodilation.

DISTURBANCES OF HEAT REGULATION

Since the metabolic rate of the body can be increased easily and rapidly to several times the basal level, a fall in body temperature is more difficult to produce. Between 82.4-87.8°F (28-31°C), a balance is achieved with neither sweating nor shivering in the nude male subject, and it is said that the individual is in the "comfort zone." When the body temperature rises or falls 1°C, there is a transfer of 66 cal. If 180 cal are transferred, heat exchange is no longer adaptive. The following may occur:

EXHAUSTION

In the unacclimatized person who is exposed to high temperatures, the individual will feel hot, complain of fatigue, and have slight mental confusion. Physical examination will reveal moist skin, profuse sweating, increased pulse, slightly decreased blood pressure, and shortness of breath. Treatment consists of rest, fluids by mouth or intravenous route, and removal from the thermal stress.

The acclimatized person who is exposed longer to thermal stress but has an inadequate fluid intake may also develop heat exhaustion. With dehydration of 4-6% of the initial weight, the individual may suddenly collapse. The findings and treatment are the same as for the unacclimatized person.

CRAMPS—In an individual who is sweating and who had an inadequate salt intake, cramps of the large muscle groups may occur. The cramps will persist until the salt deficit is corrected by oral or intravenous salt replacement.

STROKE—In this case, the individual may suddenly lose consciousness with minimal exertion. There is a complete breakdown of heat regulation and death will result unless corrective action is taken. The findings are unconsciousness, dry skin, and rectal temperatures of 106°-110°F (41-43°C). Treatment consists of immediate body cooling by cold blanket or ice packs and careful fluid replacement by vein.

PREVENTION

From the previous discussion of heat disturbances, it is apparent that water and salt are the agents essential for prevention of the disturbances.

Facts:

- The normal person requires 2-3 qts of water per day without exertion, fever, or hot weather.
- Man cannot do without water.
- The acclimatized person requires three grams of salt/day.
- An increased fluid intake will not appreciably increase sweating and there is no danger of overhydration as long as there is thirst.
- An individual should drink enough water to produce two pints of urine per day.

If one is eating a normal diet, salting food is better than taking salt tablets. If supplemental salt is necessary, no more than three tablets (2 gm) should be taken per day. Since concentrated salt solutions can induce vomiting, it is better to add two tablets to one quart of water. If the individual is on C-rations, no supplemental salt is necessary because it is used as a preservative in these foods. Protein causes increased heat production and can add to thermal stress, so low protein diets are best in hot weather.

The acclimatization to heat occurs in two stages. For the first 5-7 days, the circulatory system adapts by increasing the cutaneous blood flow. After seven days, there is decreased sweating and dilution of the sweat. In two to three weeks, apathy, loss of appetite, and the lack of desire to exert oneself all decrease or disappear; and the person is fully acclimatized.

SUMMARY

We can become acclimatized to summer weather in a relatively short time period. With proper fluid and salt intake and some modifications in diet, we can avoid disturbances in heat regulation. Finally, remember that it may not be the heat or the humidity, it may be both. ★

OPS TOPICS

F-4 NOSE STRUT



An F-4 aborted takeoff at about 165 KCAS because the nose would not rotate. The wingman's nose had rotated about 5 knots earlier. Initial investigations indicate that it is possible for a nose strut below minimum extension to increase nosewheel liftoff speed. Further testing is in progress.

WEATHER FACTOR



The pilot of a T-39 preparing for a local training flight self-briefed the weather using a closed circuit TV display. Scattered thunderstorm activity was indicated in the area of planned flight. About 30 minutes after departure the aircraft encountered hail in clouds. A PIREP shortly after the incident from another aircraft indicated sleet, hail, moderate icing and turbulence in the area.

WINDY



The C-141 was landing in a strong gusty crosswind, in fact, stronger than the crew realized, for the winds given them were 300 degrees, 16-20 kts. After landing, they found that the left wingtip had scraped the runway for about 2000 feet. A WX observation at about the time of landing recorded winds of 310 degrees, 20 kts gusting to 29 kts.

BAN ON CALCULATORS



The FAA has decided to continue its ban on the use of portable electronic calculators on aircraft operating under IFR. The FAA stated that test results on the effect of the calculators are "inconclusive and conflicting." However, there are documented incidents that certain calculators have caused interference with ADF and VOR equipment.

CG PROBLEM

In a recent private aircraft accident in which an Air Force pilot was killed the investigating board found that a contributing cause of the accident was the fact that the pilot normally flew with one-half fuel load and a light passenger in the rear seat. On the accident flight the aircraft had a full fuel load and a 200 pound passenger in the rear seat. This significantly changed the aircraft CG.

A LITTLE PLANNING NEEDED



A C-141 was being directed to a runup area for checkout of a newly installed engine. The aircraft commander could see that there was no room to turn around on the runup pad to which he was being directed. Nevertheless, he tried to turn on the widest part of the intersection and put three wheels into the soft ground.

OVER-G

The F-4 was engaged in an ACM training mission. As the aircraft commander began a supersonic maneuver he allowed the airspeed to decay to the transonic range. Although at the initial speeds G load was only 5, the "mach tuck" experienced in the transonic range increased the G to an over-G condition. Result: 50 man-hours to repair.

OPS TOPICS

CANOPY—CLOSED AND LOCKED?



Recently a fighter lost its canopy during an air defense scramble launch. The most probable cause appears to be that the pilot in his hurry did not make sure the canopy was locked prior to takeoff roll. When you go to battle it helps to take all the aircraft with you.

BREAKAWAY

There have been several cases of ice shield damage to refueling booms on KC-135's recently because receivers closed too fast and then did not react to instructions from the boom operator. A breakaway means just that: follow established procedures!

LOW BLOW



An F-100 jock had a close one when the MLG hit a tree on final approach. Why was the bird so low—or the tree so high? First, because there is no instrument approach to the runway, the clearance criteria are reduced. During a normal VASI approach the landing gear clear the trees by only 20-25 feet; however, there was no VASI system in operation because a civilian aircraft had struck and damaged some of the light boxes. There were strong, gusty crosswinds and the pilot allowed his airspeed to bleed off to 10 knots below final approach speed. The increased sink rate was not recognized or corrected before contact with the tree. Although the pilot is responsible for flying the approach, in this case he certainly got no help from the environment. Wonder why no one had submitted a Hazard Report?

HERE'S WHY

Every crash rescue crewmember has been bored by "standby" and wondered if it was really worth it. Well it is, and here is why: An out-of-control Cessna 310 attempted an emergency landing at an Air Force base. He didn't make it and crashed into a T-29 parked on the ramp. Quick, efficient response by the controllers and fire crews prevented a major disaster on the crowded ramp. To those involved a "Well Done" from Mark Hunter. ★

SURVEY OF FLIP DELIVERY PSA AND ANZA

The Defense Mapping Agency Aerospace Center will conduct a "Distribution Time Check" survey to determine the effectiveness of delivery to all addressees receiving automatic distribution of the Pacific and South Asia and the Australia, New Zealand and Antarctica FLIP Products. Three issues, with effective dates of 19 June, 17 July, and 14 August will be included in the Survey. Points of concern are timeliness of delivery, completeness, and condition of products. A separate survey letter will be sent to each addressee for each month with return address and postage prepaid. The results of the survey will be published in September and October of this year.



FOR A CLEAN BREATH OF AIR

CAPTAIN THOMAS S. WEBB, Robins AFB, GA

Editor's note: The pictures that accompanied "Corrosion: A Billion Dollar Waste" in our February issue were taken during an actual corrosion control operation. Our attempt to interject realism backfired because our camera picked up some bad examples of respiratory protection. Since so few people reported our error, we think there is a need for knowledge in this area.

Exposure to occupational diseases, caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, is best prevented with engineering controls. When these controls are not feasible, or until they are implemented, personal respiratory protection is necessary to control exposure.

The need for respiratory protection in various operations at our base had been recognized by management and documented by industrial hygiene people for many years; however, a viable respirator *program* had never been in effect. Standard Air Force stock listed respirators were issued with little regard for proper fit.

Recognizing this, the base bioenvironmental engineering office undertook a program to improve respiratory protection.

We concentrated our effort on spray painting because of numerous complaints about "inadequate" respirators. However, other areas which generated airborne contaminants were also considered.

The first step was to bring some variety and stability to the brands of paint respirators stocked by the maintenance safety crib.

We recommended that the safety crib continue to order under the standard stock numbers, but in addition, to locally procure other brands.

After three different brands of respirators and replacement filters were in stock, we visited the main paint hangar and personally fitted

each painter with the respirator most suitable for him. During the fitting, the painters were told of the necessity for a proper seal around the respirator face piece. We recommended that some beards be removed and sideburns trimmed in order to get a good seal.

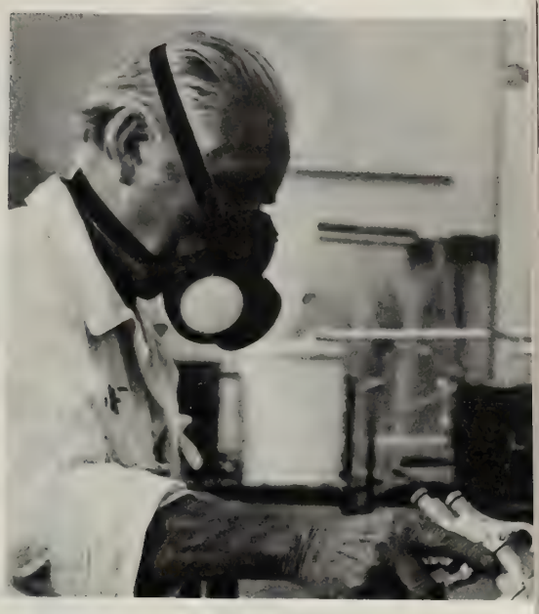
There was a wide variety of facial sizes and shapes. No one brand of respirator would fit them all. After fitting each person, the safety crib was provided the brand name of the respirator each painter was to receive and instructed to issue the same brand respirator when replacement becomes necessary.

During the fitting, eight painters complained of severe eye and skin irritation when polyurethane paints were used. The McClellan AFB Environmental Health Laboratory reported that hexamethylene diisocyanate (HMDI) in the polyurethane paint was causing the eye and skin irritation. This initiated a search for respirators with integral eye protection.

A request was forwarded to the respirator item manager to service test several types of respirators which met the necessary protection criteria. The request was approved. Service testing will determine the best respirator for Air Force operations, and consideration will be given to stock listing the respirator selected when the tests are completed.

Surveys in base areas which generate non-toxic or inert dusts showed that a surgical type dust respirator was in general use. It was not approved by Bureau of Mines or National Institute of Occupational Safety and Health (NIOSH). Further investigation showed that the respirator was a General Services Administration (GSA) stock listed item. Contacts with the GSA item manager revealed that the item description did not include requirements for NIOSH approval.

Such approved respirators *are* available. The above facts were pointed out to the GSA item manager who agreed to include the NIOSH approval requirement in the specifications. In addition, we requested that the present item be deleted and that an approved substitute be locally purchased until GSA began procurement of the newly approved respirators.





Photos show two applications of same respirator mask. Right—Painter wears respirator with filter for paint spray. Sergeant below wears respirator with chemical filter, while he refills extinguisher with chlorobromomethane.

Air Force Respirator programs must be given constant attention by management, bioenvironmental, engineering and safety personnel. A good respirator program includes:

a. Standard operating procedures for selection, fitting and use of respirators.

b. Training for workers in use of respirators and their limitations.

c. Assignment of a respirator to an individual worker for his exclusive use.

d. Regular cleaning and disinfecting of respirators.

e. Storage in a convenient, clean location.

f. Monthly inspections of self-contained respirators reserved for emergency use, or after each use.

g. Periodic surveillance of work areas to determine degree of employee exposure or stress caused by airborne contaminants.

h. Determination by the occupational medicine physician of the physical ability of the individual to wear respiratory protection and still perform his job. ★

CAPTAIN JON NEW
Directorate of Aerospace Safety

O-RING KNOW HOW





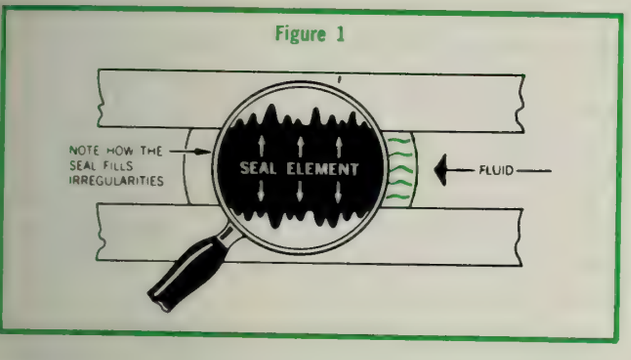
Many recent problems have surfaced concerning O-ring seals and their use within the Air Force. This article, extracted from a pamphlet by Parker Seal Company, provides sound general information and some specific points for technicians.

A problem exists very close to home in reference to O-rings—or are they gaskets or seals or packings? This nomenclature omelet really gets scrambled when you consider that what may be an O-ring in one application can suddenly become a packing or even a gasket in another. Different manufacturers frequently assign many names to a basic part just because its uses are varied.

Here's one working solution: rely on part-number identity to obtain the correct materials! If you have that number down in black and white, whatever that widget's called (an O-ring or even a "toroidal elastic pressure retarder") doesn't matter much. Granted, it may take a little longer to chase down a part number because of nonstandard names or keywords, but the insurance is worth it.

There are definitions and descriptions of these things, and perhaps we ought to take a crack at them. One goes along these lines: An O-ring's "function is to confine, and prevent passage of, liquids and gases under pressure between the parts of a joint." Another easier one: An O-ring "very simply is a means of closing off a passageway to prevent a loss or escape of fluid." One of our favorites: "O-rings are usually black and circular, and all look alike. You can tell what they do just by looking at them."

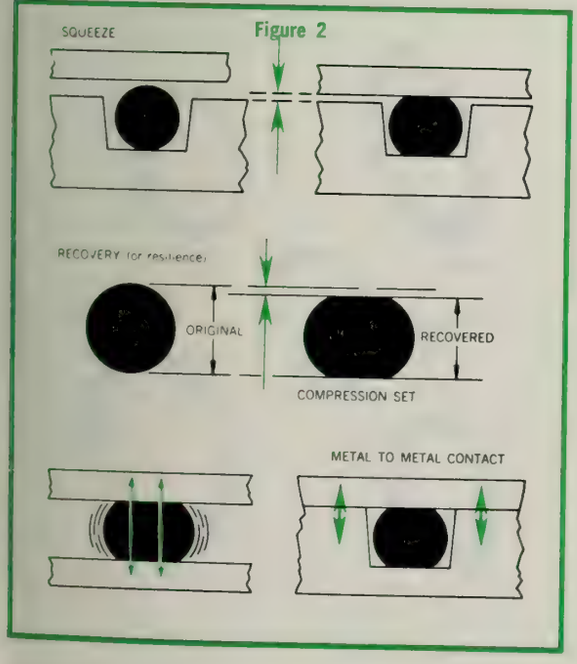
Figure 1



WHAT AN O-RING DOES

Before we go into what they do, let's examine how O-rings function. The basic principle is shown in figure 1. The O-ring element compresses under load, literally filling the super-fine passages in the mating metal surfaces, and blocks off the fluid flow. Therefore, the ability of the O-ring to "fill" the surface irregularities and its capability to maintain the "filling" are measures of an O-ring's true effectiveness. The ultimate performance of an O-ring depends on certain characteristics.

Figure 2

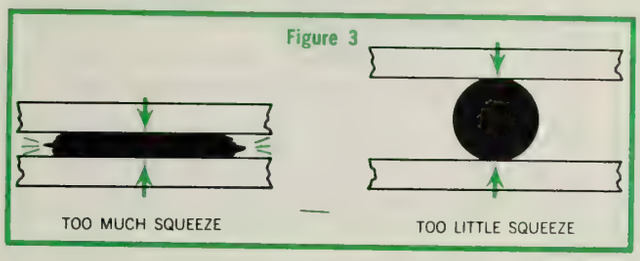


Stay with us—we're about to define and depict them for you, as painlessly as possible!

SQUEEZE

Squeeze (figure 2) is the O-ring's initial ability to be distorted and still block off a passageway. And it

Figure 3



isn't necessary to crush the seal to make it work. The effective, usable range is from 12 to 35 percent (figure 3). If you have too little, the joint will leak immediately after installation and particularly at lower temperatures. Too much, and the O-ring will either be destroyed outright, or it'll cold flow to take an early set. Too little or too much, your O-ring becomes totally ineffective.

RECOVERABILITY

Recoverability (also "resilience"—figure 2) refers to the O-rings ability to act as a surging spring over long periods. The amount by which an O-ring fails to recover after deformation is called "compression set."

METAL-TO-METAL CONTACT

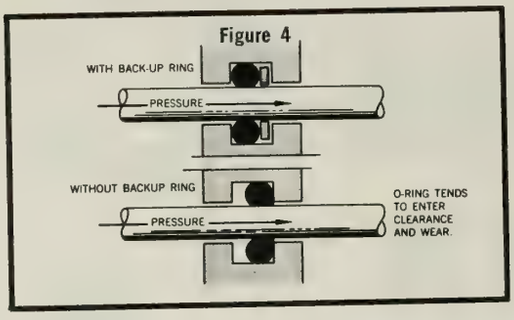
Metal-to-metal contact (figure 2) is vital to insure the correct amount of squeeze and to prevent destruction of the O-ring. In a well-designed seal, the torquing or bolting loads are transmitted through the metal, not through the O-ring.

STATAMIC* INSTALLATIONS

*No, we're not stuttering. Read on . . .

There are a couple of other terms with which you're probably familiar. These refer to the type of application. "Static" means that no movement is involved; all mating surfaces to be sealed are stationary. "Dynamic" applications occur when there is movement of one or both mating surfaces. The three basic fluids sealed by O-rings in aircraft are fuel, synthetic lubricating oil, and hydraulic fluid. Each requires a different ring, and we'll get to their selection shortly. Each, however, involves static and dynamic ("Statamic," see?) installations. The static seal is usually the simpler. Dynamic types are subdivided into a mess of others; reciprocating, oscillating, rotary and seat.

And now we can talk briefly about backup rings. A backup ring is a handy little device that works to



"prevent extrusion of the O-ring" (figure 4). When system pressure exceeds 1500 psi, the backup ring is used. In static face seals, backup rings may not be needed.

THREE FACTORS THAT CAUSE O-RING PROBLEMS

Look what happens: There's a fillion (that's a finite but large number!) of these things on an aircraft; but many are exposed to extremes of temperature and presure; others work under constantly vibrating conditions. Add all that together, and you're bound to have problems with O-rings, even under the best of conditions.

There are three factors that cause most O-ring problems:

1. *Size.* O-rings must fit correctly or their function is ineffective or totally destroyed.
2. *Compatibility.* They've got to be made of a material compatible with their aircraft environment. A good rule of thumb is that O-rings designed for one fluid are generally not good for another.
3. *Installation.* Improper handling of O-rings at assembly can make much grief. We'll discuss how it should be done later.

HELPFUL HINTS

The answers to two of those problems have, for the most part, been simply wrapped up—in paper! Manufacturers are now wrapping O-rings in individual packages of this "kraft" paper. These packages are imprinted with data that includes part number, seal compound, manufacturer's name, and special instructions if necessary.

O-ring size cannot be determined by color code. Exact replacements can only be determined by part number. (That's getting to be a familiar tune.) Don't try to match by feel an O-ring removed from an assembly. Sure it goes against your grain to rely on numbers rather than refer to the actual sample you're holding. Sure, we all hate to pay income tax—but it has to be done!

There's one other thing: Don't open that package until you're ready to install the O-ring. The wrong ring might get in, the right ring might get out and be damaged or misplaced.

TECHNIQUES FOR REMOVING OLD RINGS

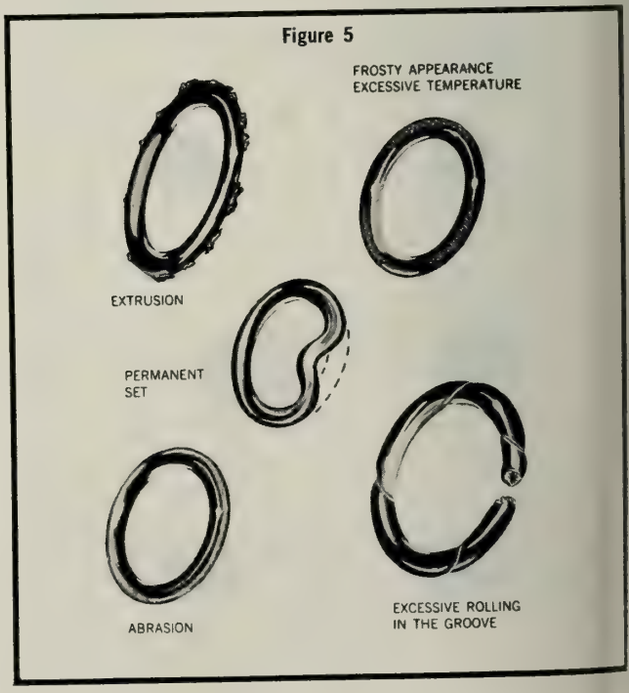
Here's where we separate the men from the boys; removing an O-ring is a highly critical operation. In fact, a poor installation often begins when an old seal is removed. Here are some points to bear in mind.

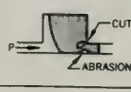
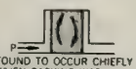
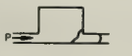
REMOVAL

- O-ring removal involves working with parts that have close tolerance surface finishes. In critical surface finish areas, scratches, abrasions, dents, and surface deformities cause faulty seals, resulting in functional failure of components.
- Don't use hardened-steel, pointed, or sharp-edged tools (knives, screwdrivers, church keys) for removal or installation of O-rings or backup rings. Soft-metal tools such as brass or aluminum are okay, and tools of phenolic rod, plastic, or wood can be formed into useful aids to help ring removal and installation.
- Tool surfaces must be well rounded, polished, and free of burrs. Check your tools often, especially those surfaces that come in contact with ring grooves and critical polished areas.
- When O-rings and backup rings are removed from pistons and cylinders, every effort should be made to avoid contact with critical surfaces of parts.

INSPECTION

O-rings in service undergo slight swelling and softening, and may be invisibly worn. Increased damage can occur on reinstallation; therefore, new rings only should be used. Inspection of old, damaged rings can indicate failure from wear, extrusion, excessive permanent set, torsional strain, or excessive rolling in



FAILURE	GENERAL CONDITION	EXAMPLE
Progressive cutting by corner of piston groove.	Pulsating pressure on O-Rings.	
Progressive cutting as in static packing plus abrasive wear.	Pulsating pressure on O-Ring.	
Knibbling extrusion. Rupture of material, large pieces torn off.	Fatigue from shock loads, high temperature, local seizure, pulsating pressure, etc.	
Rotation of part or all of circumference of packing in groove. (sometimes called "spiral failure")	Complete explanation not found. Occurrence not predictable. Possibly sudden increase in friction on working face.	
Axial grooves worn in working surface.	Imperfections in cylinder surface. Particles of dirt, metal, or rubber.	
Axial grooves as above.	Rapid passage of oil across working face.	See above sketch
Packing totally extrudes through clearance space.	Large radial clearance. Soft packing.	

the groove (figure 5 and table 1). Excessive extrusion can indicate the wrong type of ring was used originally or that backup rings were not installed.

Irregular wear may indicate a rough spot in the cylinder, or an eccentricity. The ring can also fail from a defect that should have been found by a careful preinstallation inspection. O-rings that lack proper resilience may have been subjected to overtemperatures. Because rings are not designed for high temperatures, they should be replaced, regardless of their appearance, when it is known they have been subjected to unusual heat. Overheated rings are hardened, crack with flexing, take a set, and lack resilience.

After you've inspected the old ring, cut it in two places, and throw it away.

So, now you've got the old ring out, and you're ready to install the new one—oops, hold it! There are a few things to check first.

INSPECT SURFACES, RINGS

Metal surfaces must be free of dust, dirt, and gunk before assembly. Stoddard solvent (a kerosene base with a rust inhibiting film) cleans parts and leaves a good surface for lubricating grease to adhere to. But look out! These cleaning fluids can cause some O-rings to swell up like a toad and cause trouble. So, be sure the metal cleaning fluid will not harm the O-ring if any of it is left on the surface.

Assume you've selected the proper replacement O-ring—and it is the proper ring; you just checked the part number!—so now the job is to examine the ring itself for imperfections, dirt or lint.

Open the package. If you find any faulty rings, throw them out after you've cut them (and, if they're from bulk storage, check the rest of the batch). New rings that are too tight when installed should be discarded, not returned to storage because they may have been slightly damaged during installation. After installation, an O-ring should seat snugly but freely in its groove.

Here are a couple of other hints: Be sure the smooth surface of the ring isn't scratched by fingernails, tools, or fitting threads. Don't pinch the ring between the boss and fitting. Watch for sharp edges on groove shoulder or fitting. Thread burrs are often removed by running a nut onto the thread.

Before any installation, lubricate the ring and bearing surfaces with a light coat of grease; but lubricate sparingly.

Leak-causing distortion can result if the O-ring is stretched too much. Lubrication not only helps eliminate this, but also lets the rings seat naturally in grooves without twists or wrinkles. But remember to use a lubricant that is compatible with the O-ring material and the system fluid!

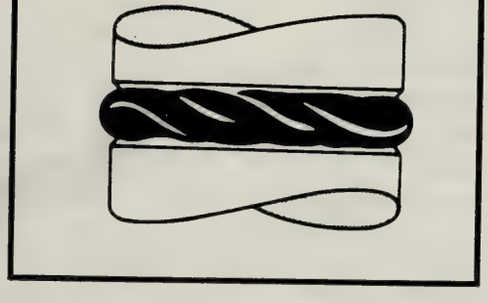
In a hydraulic system, flow-wash the bearing surface with hydraulic fluid, and wipe the parts if necessary, only with a lint-free cloth.

If you're working with an oxygen system, don't permit oil or grease around the O-ring. Oxygen is a very dangerous gas; get it in the presence of oil or grease, and it goes—but good!

INSTALLATION TECHNIQUES

During installation on, say, a piston, you'll have to stretch the ring. Stretch it as little as possible, and try to stretch uniformly. Once it's installed, be sure to remove any twists in it (figure 6). When you push the piston into the cylinder, push straight in and not with a turning motion. Turning motion tends to bunch and cut the O-ring, eventually causing leakage.

Figure 6



For some installations, the ring has to be slipped over sharp edges, such as screw threads. Cover edges with thin plastic tape or aluminum foil, lubricate ring, and work it into position (figure 7). Or construct a thin thimble of plastic, push it onto threads, and work ring into position over thimble.

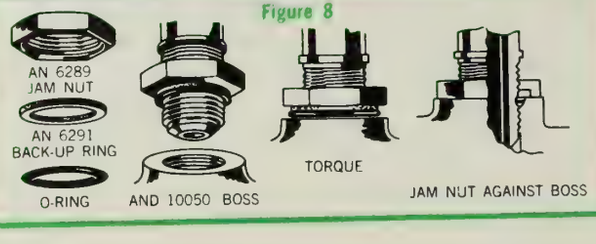
Figure 7



TAPE PROTECTS O-RING
DURING INSTALLATION

Other installations are more involved, such as placing a ring in a positioning-type AN universal fitting (figure 8). In this case, an AN-6291 backup ring is lightly coated with lubricating grease and then worked into the counterbore of the jam nut (AN-6289). The

Figure 8



O-ring is stretched and rolled over the fitting threads, and onto the smooth threadless surface designed for the backup and O-rings. Next the jam nut is pushed firmly against the lower threaded section of the fitting.

The fitting is installed in the boss (AND-10050) until the O-ring contacts the boss and increases the torque. The jam nut is held stationary in this position while 1½ turns are applied to the fitting. The fitting then may be turned into the boss not more than one additional turn to position it. Final step is to hold fitting, and torque jam nut in accordance with applicable figure or drawing.

A similar procedure is used for nonpositioning type fittings, except that the jam nut and backup ring may be omitted.

Backup rings provide a firm surface against which the O-rings can press to avoid being extruded, under high pressures, into the clearance between the surfaces being sealed. Any movement between the surfaces with the ring so extruded would result in a high wear rate, leading to eventual ring failure.

A backup ring must be installed on each side of the O-ring if the pressure is in alternate directions (figure 9). Where a single backup ring is used, it is installed on the downstream side of the O-ring.

OTHER PROBLEM AREAS INCLUDE

CONTAMINATION

We've learned a lot about O-ring contamination over the years; as a result, there has been a continued improvement in the way the rings are handled, shipped, and stored. And your job is easier. But there are some things you should be aware of as a matter of course. Let's review briefly.

DUST AND DIRT

By now, these should really make you jump. If your rings are individually packaged, you have no worries. But if they are from bulk, and you have the slightest suspicion that the rings have been exposed to dust, discard them. Dust is a very tough abrasive, worse because it's frequently unseen or unnoticed.

ATMOSPHERIC CHEMICALS

Ozone, oxygen, and moisture will, over the long haul, act on O-rings. Today, most manufacturers add chemicals that slow down or eliminate the effects; again, individual packaging also helps.

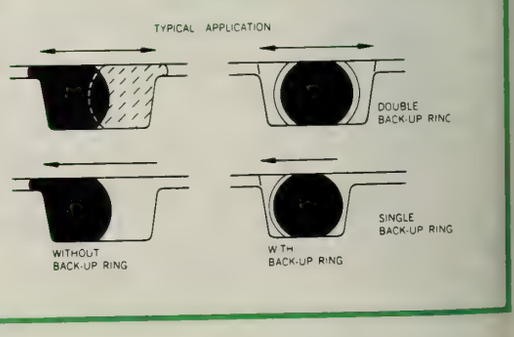
HEAT AND LIGHT

If you're beginning to get the idea that O-rings are as delicate as your maiden aunt, forget it. We only suggest you treat 'em as though they were. Excessive heat is a problem, however. If the stockroom guy has been storing your rings on the top shelf, near the corrugated-iron roof, remove the rings, throw them away, and store that stock man up there—preferably all summer! Additionally, sunlight and fluorescent light have a tendency to age the O-rings prematurely, so they should be protected from these.

REMEMBER

- Select the proper O-ring on the basis of part number identity.
- Keep all parts clean.
- Use compatible fluids and rings.
- Use individually wrapped rings.
- Don't use hardened-steel tools for removal or installation.
- Make it your business that new rings are not contaminated and are properly protected. ★

Figure 9

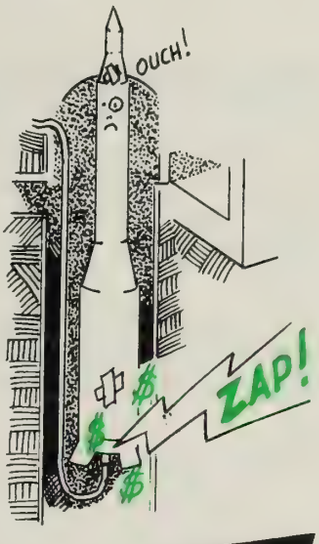


MISSILE TOPICS



MORE THAN MEETS THE EYE

Tech order checklist procedures are essential for safe and effective task accomplishment. They are not, however, enough by themselves. An understanding of the overall system and general safety precautions is necessary. A recent missile incident at a Minuteman launch facility demonstrated this point. An electro-mechanical technician performing a battery charger checkout procedure accidently mated two male connectors, thereby causing considerable damage. This missile incident occurred because an important section of the tech order was ignored, the "Introduction." In this case, the introduction specified that a close inspection of each connector should be made prior to mating. Innocuous, yes, but very critical. The point to remember is that there is more to tech orders than the procedures . . . there are the safety precautions and general information in the introduction. Supervisors should emphasize their importance and everyone should get in the habit of reviewing them thoroughly along with the applicable procedures for a specific task.



THE ONE THAT WOULDN'T QUIT

ACT 1 (Missile Incident) Failure to respond to malfunction indications precluded timely detection of Missile Guidance Set (MGS) cooling system blockage which would have prevented a wet missile, MGS damage, sodium chromate contamination of the missile and sodium chromate contamination of the missile site. Cost est. $60,000.

ACT 2 (Missile Incident)—During the subsequent investigation, failure to follow a technical order culminated in damage to the missile lower umbilical when it was dropped during the removal process. Cost est. $300.

ACT 3 (Ground Accident) The umbilical was shipped to the Air Logistics Center for repair. There it was discovered that a nail in the shipping container cover had been driven into the cable. The cable was subsequently condemned. Cost est. $6,000.

THE END??? We hope so.

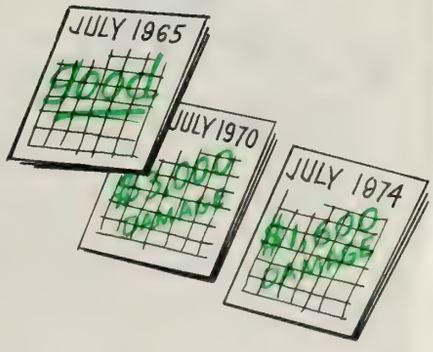


LEST WE FORGET . . .

Ten years ago we had a very good month.

Five years ago a Minuteman missile maintenance man, while drilling drain holes through the launch tube liner at a launch facility, negligently drilled into the missile lower umbilical cable causing approximately $3,000 damage.

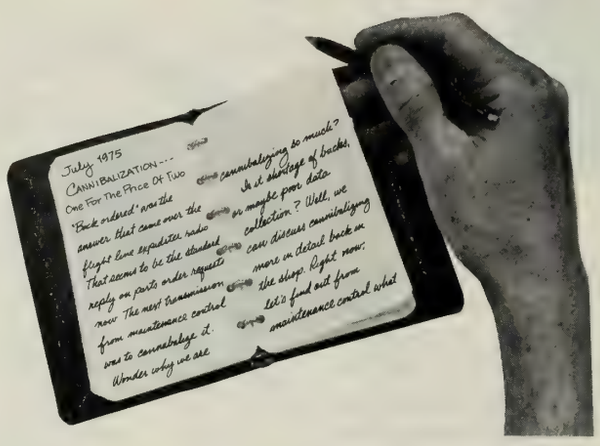
One year ago failure of the environmental control system fan in a Minuteman launch facility resulted in overheat damage of $1,600 to power supply drawers.



COMMON MISTAKE

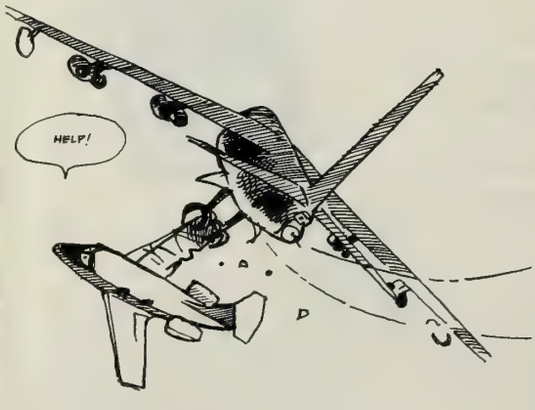
Two lock retainers fell and struck a missile, two male connectors were mated together, an environmental control system switch was left off, and a connector was crossthreaded. What do these events have in common—several things. They all occurred in the first quarter of calendar year 1975, they all occurred during maintenance on Minuteman missiles, they all happened before, they all were caused by failure to follow tech data, and they all resulted in missile incidents. The message is a simple one. The way to reduce mishaps caused by people is to ensure strict compliance with tech data.

CANNIBALIZATION ONE FOR THE PRICE OF TWO



NOTES FROM A LINE CHIEF'S DIARY

SMSgt HAROLD O. EASDALE
Directorate of Aerospace Safety



"Back ordered" was the answer that came over the flightline expediter radio. That seems to be the standard reply on parts order requests now. The next transmission from maintenance control was to "cannibalize it." Wonder why we are cannibalizing so much?

Is it a shortage of bucks, or maybe poor data collection? Well, we can discuss cannibalizing more in detail back in the shop. Right now, let's find out from maintenance control what aircraft we are supposed to cannibalize from. Let's get on with it because we will have to work overtime to finish this job so the aircraft can make the mission tomorrow morning.

Cannibalize. What does that mean? Well, here's my definition: Cannibalization is the authorized removal of a specific assembly, subassembly, or part from one weapon system or equipment end item for installation on another similar equipment end item, to meet priority mission requirements.

Cannibalization normally doubles the maintenance effort to correct a single malfunction. As a result, it is an inefficient but legitimate source of serviceable items. It may also result in the use of more maintenance resources than authorized for accomplishment of the normal mission requirements. Therefore, it should be resorted to only in unusual situations, after consideration of man-hour availability and mission accomplishment.

Some of the following conditions should apply: (1) Cannibalization satisfies an existing NORS condition, (2) Cannibalization will prevent a NORS condition, (3) Last minute cannibalization to meet essential mission requirements.

Cannibalization can influence many things:

It can increase manning requirements by doubling the work.

It has a definite effect on morale of maintenance personnel because of double work and wasted efforts.

There is a possibility that it will induce a higher failure rate on certain items removed and replaced.

With our FOD problems, cannibalization creates more possibilities for FOD.

There are numerous actions that all maintenance personnel can



accomplish that will be a big help in reducing the number of cannibalization actions. This starts with the working technician and goes right to the top supervisor.

Analyses indicate that inaccurate documentation is the major contributing factor leading to excessive cannibalization. At one base, maintenance and supply personnel had not taken advantage of all the avenues open to them to resolve their problems of recurring cannibalization for certain assemblies/subassemblies. Eight items had been cannibalized more than 18 times, each within a time span of 6 months; however, no supply difficulty letters had been initiated for any of these items.

In reviewing a maintenance data collection 6-month report of 24 cannibalization actions sampled, the report contained only three documented "cann" actions. One of the actions had a replacement (U) action with no associated removal (T) action, and one had the wrong aircraft tail number listed. There were 28 selected cannibalization actions traced to the daily NORS start/stop reports. Six of the 28 approved cannibalization actions were not included in the report.

Review of 31 delivery receipts for in-shop cannibalization for a 50-day period showed that 23 of these parts were sent to the incorrect tail numbers, resulting in wasted man-hours and the possible loss or misuse of Air Force assets. In-shop cannibalization required a manual entry changing the tail number in the "marked for position" of the supply document. These changes were not being entered into the system. Maintenance supply liaison should ensure that stock control is aware that a change in tail number is required and stock control should ensure that all tail number changes are accomplished.

The failure to prepare and process required source documents into the Maintenance Data Collection System (MDCS) results in incomplete data being reported and denies managers valuable information affecting maintenance, manning and supply problems.

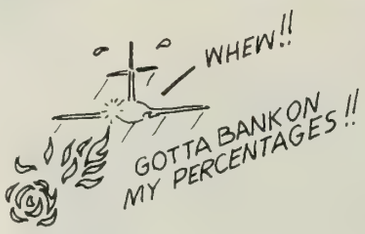
Listed are some of the errors:

- Cannibalization action was started after the time the part was required to meet the mission as entered in the "date/hour required" block, AF Form 991.
- The time entered as approved by the chief of maintenance was subsequent to or the same time entered in the "date/hour required" block.
- Cannibalization removal action was commenced prior to the time entered as approved by the chief of maintenance.
- The time approved by the chief of maintenance was not entered.
- No time was entered in the "date/hour required" block.
- Installation of the cannibalized item on the receiving aircraft (action taken code "Q" or "R") was not documented into the MDCS.
- Installation of the cannibalized item on the receiving aircraft was completed prior to completion of the removal from the donor aircraft.

Cannibalization may sometimes be necessary, but only when absolutely necessary and properly authorized and documented. Why work two days for one day's pay? ★

tech topics

flameout at 19,000 feet



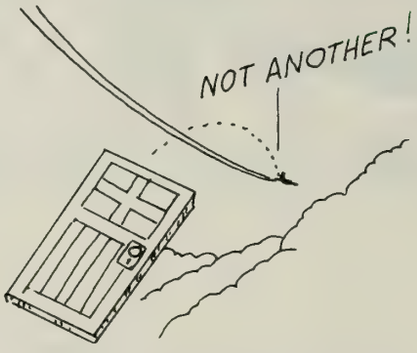
As the throttles were retarded on the T-37, the left engine flamed out at 70 percent. The pilot got a restart using the emergency air start procedure. However, rpm again decreased through 70 percent and the left engine flamed out. The engine was restarted the second time and engine rpm set at 80 percent for recovery and landing. The cause was improper adjustment of the fuel control linkage.

misaligned marks

During a night IFR round robin in a CH-3 the aux hydraulic pressure began fluctuating and dropped below 1,000 PSI. The system was turned off and an emergency declared. Investigation revealed the head on the utility hydraulic pump was installed one bolt hole off of the index marks. This allowed one of the bolts on the utility pump to rub against the T-fitting on the auxiliary hydraulic pump. Flight vibration and constant rubbing caused the T-fitting to crack and the system to fail.

An F-4 pilot noticed rudder oscillation during takeoff. As the aircraft accelerated above 250 knots oscillations increased. Yaw aug was turned off and the oscillation did not recur. The oscillations resulted from the fact that the four screws on the bulkhead side of the rudder actuator cannon plug were the incorrect type. The button head type screws that were installed allowed the cannon plug to work loose, allowing spurious inputs to the rudder. The screws should have been the countersunk type.

lost in flight

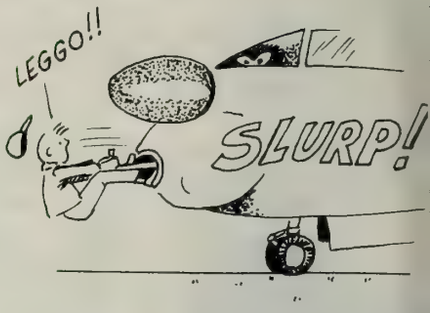


We're still losing a lot of panels in flight. Here's just one case which tells why. An F-101 lost door 212L after takeoff. On engine start the left engine failed to start. The crew chief opened door 212L to check the ignition circuit breaker. The second engine start was successful. Door 212L was closed but not secured. The end of runway crew failed to detect the unsecure panel and it was lost during flight.

plugged

During an engine test cell run on a TF41-A1 engine, the test cell instrumentation showed engine vibration after 20 minutes operation. The test was stopped and the engine sent to penalty line rework where turbine damage was discovered. The engine was routed back to the teardown area for analysis and quality audit of damage. Teardown revealed that during assembly a plastic plug was left in the oil filter pressure outlet causing oil starvation.

more FOD



During pre-launch arming, the nr 3 man of the arming crew pulled the MAU-12 rack pins from the right wing of the A-7 aircraft. He then crossed from right to left, in front of the aircraft, about 5 feet from the engine intake. The MAU-12 pin and red streamer were pulled from his left hand and ingested by the engine. Cost: $95,000 and 20 man-hours.

During a KC-135 landing rollout, the nr 4 engine fire light illuminated. The engine was shut down and firemen put out the fire. The cause was that safety wire was safetied to the cap of the fuel pressure sensing line but the cap was incorrectly installed. The loose cap allowed pressurized fuel to spray on hot metal parts of the engine and ignite.

wild ride

The T-39 crew landed after a long enroute leg. They were nice and light and when the pilot tried to engage the nosewheel steering, it didn't engage. It seems that someone had installed the left main gear squat switch 180 degrees out of phase, so there was never a gear down signal to the nosewheel steering. Since there was a good crosswind from the right, the right strut extended and that switch cut out. Then when the wind started to blow the aircraft off the side of the runway the pilot could do nothing but hang on.

Power to the battery buss and solated DC buss on a C-130 was ost because a wire was left un- ecured after the isolated DC buss everse current relay was replaced.

louble jeopardy



On his last flight in a T-39, the ilot had a malfunction which aused him to run off the runway. he malfunction was the result f an improperly installed switch. he next time the pilot went out o fly he found the nosewheel teering cannon plug disconnected a red X item) and no entry in the orms. This pilot is beginning to ink maintenance is out to get im.

The bomb bay doors on a B-52 nd two SRAM missiles were dam- ged because the bomb bay latch in was not secured with the prop- r nut and cotter pin.

luggish

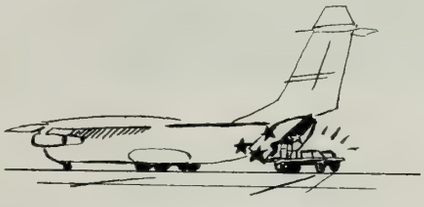
As a pilot taxied his C-130 into he parking area he noticed that evator control was sluggish. The oke bound in the full aft position. uring maintenance trouble-shoot- g they discovered that the eleva- r trim tab actuator cover panel as loose and blocking the eleva- r center torque tube.

afety tip

According to the director of ma- riel management at Warner Rob- s ALC, inerting fuel tanks with carbon dioxide (CO_2) is an unsafe procedure. Although carbon dioxide is an inert gas, its electrostatic generating qualities render it unacceptable as an inerting material. TO 1-1-3 is being changed to delete CO_2 as an inerting agent.

An F-101B pilot had to shut down the right engine in flight for low oil pressure because an improper clamp was installed on the CSD oil line, and a hole chafed in the line resulting in loss of engine oil.

runaway loader



The C-141 had been loaded and the 25-K loader was moved away from the aircraft and parked. The driver then returned to help tie the barrier net down. The next thing he knew, the 25-K loader had hit the left petal door. The operator had parked the 25-K loader without chocking it and left the engine running. Mechanics checked after the accident and found that the hand brake would not hold the vehicle when it was in gear with the engine running in idle.

pressure chamber

Immediately after takeoff the F-104 started pressurizing excessively to the point the pilot had an unbearable earache. After he dumped pressure, his ear pain still persisted. He was able to clear the left ear but the right was still blocked. The pilot reported that the unbearable ear pain caused a sort of daze; however, he maintained control of the aircraft and made an uneventful landing. The isobaric manual shutoff valve was found in the test position and the safety guard for the lever was broken and not safety wired. With the valve in the test position, the cockpit pressure regulator immediately starts its pressurization schedule at a simulated cockpit pressure of 5000 feet. Prior to flight, maintenance had been performed in the cockpit pressure regulator area to repair the fire control radar. It is suspected that the guard was broken during maintenance on the fire control radar, and the isobaric valve was placed in the test position.

The items printed in green would not have happened if the tech data had been properly used.

hot truck



You can't be too careful about what you throw into the trash. A sanitation truck crew found this to be true when the contents of their truck went up in flames. Seems that at one stop they picked up some calcium hypochlorite which, when mixed with wet garbage, caused a chemical reaction that produced enough heat to ignite flammable materials in the trash. The incident emphasizes the need for compliance with storage procedures for class 8 and 9 health hazard supply items—AFM 67-1, Vol II, Part 2, Chapters 8 and 21. Before disposing of any such materials, check with your BEE (bioenvironmental engineer). ★



Under "Sharp Troops" on Page 19 of your January 1975 issue there is a slight mistake. It was two "POL" troops, a SSgt and a Sgt, who discovered the blue lint in the Hose Cart Strainer and notified the Fuels Dispatcher who, in turn, notified the Base Fuels Quality Control Section and Maintenance Job Control.

PEYTON L. TOMLINSON, MSgt, USAF
Fuels Superintendent
K I Sawyer AFB MI 49843

Reference the article "Lost Pylon" on page 18 in the AEROSPACE SAFETY magazine, January 1975. The article has an important message; however, technical errors detract from the effectiveness of the article. To begin with, the title of the article is wrong. The SUU-21 practice bomb dispenser was lost from the aircraft and not the pylon. Anyone that has worked around F-4 aircraft should realize that, except for the 370 gallon integral fuel tank pylon, impulse cartridges do not provide a capability for jettisoning pylons from the wing. Secondly, I seriously doubt that the SUU-21 was being carried on the left outboard pylon. Normal configuration would have the SUU-21 on either the left or right inboard armament pylon. My assumption is further confirmed by the fact that the F-4 does not carry triple ejector racks (TERs) on the outboard stations.

The article also misses an important point. The personnel which loaded the SUU-21, were also at fault. Had the proper functional check been performed by the personnel that installed the SUU-21 on the aircraft. the cartridges would most likely have fired at that time. The armament pylon safety pin only mechanically safes the rack. Through nuclear circuitry the same release signal is provided to the SUU-21 and the pylon breeches simultaneously.

I enjoy your magazine. Expansion of the Tech Topics Section would make the magazine of more value and interest to maintenance types and possibly to aircrews as well. Thank you for listening.

RODNEY C. WIDNER, Capt, USAF
Chief, Standard Data Branch
Directorate of Munitions
Langley AFB, VA

DEFENSIVE FLYING

The following letter was sent to us by the 355 TFW Flying Safety Officer for use in AEROSPACE SAFETY. We're glad to pass it on and hope every pilot reads it.—Ed.

1. All of you, I'm sure, are familiar with the term "defensive driving," but how about "defensive flying?" In case you're wondering—consider an IFR situation where you're being vectored at low altitude by a radar controller. Now, suppose you receive a vector and an altitude that will run you into a hill—but, you're sharp. you know your position and are familiar with the local terrain, so you advise the radar controller and request immediate clearance to a higher safe altitude. I'd say that was "defensive flying." If you're not convinced—consider yourself Number One for the active and the Tower has cleared you into position to hold. As you begin to move you crane your neck and scan the approach course—Lo and Behold! There's an aircraft over the threshold about to land, so you stop short I'd say that was "defensive flying," considering you ca log five minutes of ground time as flying time.
2. The two incidents just mentioned really did happen except "defensive flying" was not applied and two fight er pilots died needlessly. In the first instance the pilo allowed himself to be vectored into a mountain. In th second instance, the pilot took the active and an ap proaching aircraft landed right on him.
3. The Air Force can provide a full rewarding caree if you live long enough to collect it. Your cooperatio and Heads Up thinking are necessary. Knowing a much as you can about all aspects of your flying en vironment will insure fulfillment in an aviation caree
4. I hope I've made my case for "defensive flying"— for your sake.

William J. Hosmer, Col, USAF, Commander
355 TFW (TAC), Davis-Monthan AFB AZ ★

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Well Done Award

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and professional

erformance during

hazardous situation

and for a

nificant contribution

to the

ited States Air Force

Accident Prevention

Program.



Captain
ARCHIE E. RODGERS, JR.
28 Bombardment Wing, Heavy (SAC)
Ellsworth AFB SD

On 10 September 1974, the B-52 crew was returning from a training mission and the aircraft commander, Captain Rodgers, had just landed the aircraft at near maximum gross weight for a taxiback landing. The drag chute was not deployed and as Captain Rodgers applied the brakes for the 90 knot brake check, he discovered that he had no brakes and was rapidly running out of runway. Realizing that the drag chute would have little effect at his present airspeed and the aircraft could not be stopped within the runway remaining, Captain Rodgers started go-around procedures, immediately accelerated to takeoff speed and flew the aircraft into the air before running out of runway. He climbed to a safe altitude and advised others of his emergency. With two aerial refuelings, Captain Rodgers flew to Edwards AFB, California, where he burned off excess fuel to lighten the aircraft to a landing gross weight of 215,000 pounds. Upon touchdown Captain Rodgers deployed the drag chute, raised the airbrakes to position six and completed the "emergency brake failure checklist." The aircraft coasted to a stop, 9,000 feet down the runway. The aircraft knowledge, preplanning and immediate action demonstrated by Captain Rodgers and his crew reflect the highest standards of aircrew performance. WELL DONE! ★



If You Fly A Light Plane

Annie Wolf calls your attention to article "Losses in Private Flying," page 4. Good reading for Air Force personnel who fly general aviation aircraft.

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SAFETY AUGUST 1975



FLYING THE THUNDERSTORM

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UNITED STATES AIR FORCE AUGUST 1975

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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AUGUST 1975 AFRP 127-2 VOLUME 31 NUMBER 8

Does SAFETY Limit Operations?

LT COL THOMAS E. BLEVINS, Directorate of Aerospace Safety

Recently I overheard a discussion of the limits safety places on the mission. The point of view expressed stated that we had made as much progress as we could in reducing our accident rate. Any major effort to get the rate lower would, by necessity, place large constraints upon operational flexibility .

Certainly flexibility is a key ingredient in effective employment of Air Forces. Yet I do not share the concern that safety is, in fact, a "constraint." I see safety as one of the basic guidelines to any operation. It provides Ops with a better evaluation of their forces and guarantees a force ready for the future.

Let us look at two roles where safety is an asset to operations. One is identification of limiting factors, and the second is the prevention of accidents (conserving resources).

IDENTIFICATION OF LIMITING FACTORS

From the very beginning we plan to lose airplanes. We forecast these losses in the initial contract and budget for their replacement. This provides an idea of the size of our Air Force in the future. For example, the F-15 contract foresees as many as eight losses per 100,000 flying hours once the system is fully employed. Then, as a weapons system matures and develops, problems not forecast begin to occur. Safety now warns of the nature of those problems in terms of risks versus employment options.

A few years back, the F-100 had severe problems with its engine. After several crashes and many incidents, we were able to identify the problem. The fix called for major and expensive overhaul work requiring about a year to complete. Grounding the aircraft until fixed was one option. This of course would lower aircrew proficiency, therefore possibly creating more safety problems than originally existed with the engine trouble. The decision was made to continue flying the F-100 while modifications were underway. We accepted the risk of the engine problem, yet modified our operation through increased emphasis on engine inspection and maintenance, and we were able to continue the F-100 mission.

Similarly, in past years the F-4 has sustained losses from in-flight fires. We identified several deficiencies which led to these F-4 fires. The fixes for this problem are underway; however, because of money and maintenance time required, the fleet will fly several more hundred thousand hours before the last plane is completely fixed. In highlighting problems such as those mentioned and by forecasting a certain number of losses, more accurate facts are available to assist in operational planning and employment. By focusing on these problems we also reduce the probability of their repetitiveness.

Less specifically, safety provides facts for all aircraft simply by recording and publicizing past loss rates. An example of this is that for the past 5 years we have

Does SAFETY Limit Operations? continued

averaged 5.1 major accidents per 100,000 flying hours in the F-4. We can certainly forecast that rate for the next few years while we continue to take steps to reduce it.

That is, of course, the very broadest application of safety as it applies to developing aircraft, forecasting operational assets and identifying operational limitations. Accident prevention is the more specific application and the one which is closer to you and me.

ACCIDENT PREVENTION

Accidents identify features of our system which have gone unnoticed. They reveal deficiencies in our management, maintenance and procurement systems; they highlight our imperfections.

For many years we flew at any time, day or night. We gave little consideration to aircrew limitations. When an aircraft crashed late at night, with no known malfunction, we declared it "pilot error." Eventually we began to take a closer look at these accidents and discovered that while tired pilots could probably perform their routine duties (takeoff and land), added stress, i.e., tough mission, aircraft emergency, or bad weather led to an accident. Safety suggested limits be applied to guarantee a fresh aircrew. This caused much complaining from flight schedulers and, I guess, in some cases still does.

In enforcing a planned and orderly schedule based on crew rest, we gained several things. The training a fresh crew gets is more effective: morale improves because no one's pressed; and the mission is more efficiently accomplished. All this is achieved because **safety dictated limits in aircrew endurance.** We did this with no substantial increases in manning to support this safety "constraint."

Another area that safety stepped into, to the chagrin of many Ops officers, was to fly aircraft with two seats and two sets of controls with two pilots. This all started in the late '50s when we had a surge of staff officers flying T-33s to maintain flight proficiency. We crashed many of these birds solo before we recognized the problem of solo proficiency flying. Again this forced us into better planning and scheduling. It also forced us to recognize that when we fly those aircraft solo, we lose 50 percent of an aircraft's training capability. We were using a million dollar machine at half its potential. Thus, safety "constraint" has made us more efficient.

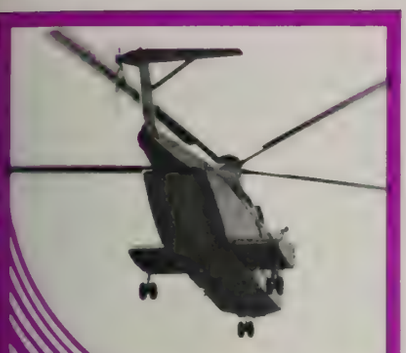
We could discuss many more of these safety "constraints." ACM safety rules have taken us from the rat race to a controlled, effective training program. How many parts **got** delivered because we forced pilots to compute their takeoff roll. How many "time hogs" were forced off the schedule because we required all to get their fair share of the flying time. The list is long and it clearly shows that safety has not only prevented individual losses, but has clearly increased the efficiency of our operations.

Now let me turn briefly to our accident rate. Is it as low as it's going to get? Certainly not. It will go lower. Probably the rate at which it decreases will not be as dramatic as in recent years, but nevertheless, we do have room for improvement.

This year our accident rate could well break past records, yet when we wind-up 1975 we will look back and say we could have done better. It could have been better without putting any constraints on operational and mission performance. Some examples of accidents we could have done without: two pilots of a T-33 heavy with fuel, attempt to roll at low altitude over a relative's house (sounds like the 1950s); a flight of two OV-10s perform low altitude, in-trail acrobatics, only one recovered; an F-100 crashes under similar circumstances; an F-4 crashes into a hillside flying VFR in IFR conditions. These accidents could have occurred in any year (and probably did); they all occurred this year.

So, I put it to you that, while safety may arrive in the arms of disaster, its implementation invariably improves the efficiency of flight operations.

Finally, let me call to your attention the unit safety officer who points out hazards within a unit's operation. Is he pointing out a hazard, or is he pointing to an area of weak management? Is this a limiting factor or a chance at improved operation. ★



UPSET BY THE WIND MACHINE?

LT COL OWEN A. HEETER
Directorate of
Aerospace Safety

It is common knowledge that if you walk in back of an engine being run up you will encounter a prop or jet wash of significant velocity. Also many, many words have been written about fixed-wing wake turbulence but the effects of helicopter rotor wash and wake turbulence haven't received so much attention. There are several airplane drivers around who will vouch for the fact that an encounter with helicopter rotor wash or wake turbulence can be very "upsetting"!

Every aircraft generates a wake in flight and the strength of the resulting vortexes is governed, in the main, by aircraft weight and speed. Current military helicopters vary in weight from about 8000 pounds to well over 40,000 pounds. This weight range covers most fighters and twin-engine transport aircraft and far exceeds all light civilian aircraft. Helicopters cruise at speeds from 80 knots to 150 knots but the speed of the rotor tips—the vortex generators —can exceed 500 mph!

The strength and effects of helicopter wake turbulence can equal or exceed that of the medium —and/or heavy-weight fixed-wing aircraft. This is especially true of the larger helicopters. Therefore, it would behoove all pilots and traffic controllers to use the same precautions for helicopter wake turbulence as presently used for fixed-wing aircraft.

Another aspect of helicopter operations that needs emphasizing is that of rotor wash. A hovering helicopter can generate extremely high wind velocities—up to 100 mph directly under the helicopter—that may extend out from the helicopter several hundred feet. That intriguing, harmless-looking helicopter hovering near the parking ramp or approach end of the runway can, in fact, be creating an extremely hazardous situation. Helicopter rotor wash has caused parked aircraft to flip over and landing aircraft to go out of control.

The helicopter is definitely a "wind machine" of the largest proportions and proper precautions should be used by both the helicopter pilot and others in the immediate vicinity. Helicopter pilots must be particularly aware of the hazards they create, especially when operating out of small civilian airports. Traffic controllers should also keep this in mind when directing hovering helicopters for parking or takeoff. All aircraft drivers should give the hovering helicopter a wide berth and avoid helicopter vortexes just as you would those of a jumbo jet. Don't let yourself get "upset" by the wind machine! ★

Picture at left shows the pattern of the rotor wash. Center photo illustrates the high velocity wash of a hovering helicopter. Rotor wash is particularly hazardous to parked aircraft. Pilots should be very alert in situations like that in the picture on the right.









NO WINNER IN A . . .
BIRDSTRIKE

CAPTAIN N. C. GREENHALGH
366 Tactical Fighter Wing
Mt Home AFB, ID

The mission was routine, proceeding as pre-briefed in the squadron briefing room three hours earlier. The F-111 had just been put on Terrain Following Radar (TFR) at 1000 feet AGL for a low altitude, high speed route with a ground speed of 480 knots.

Captain James D. Thompson, an IP, sat in the left seat with 1Lt Victor A. Sorlie, a student pilot systems operator, in the right seat. In five minutes, the two would be in a predicament that would prove them and the training they had received. They would be reacting automatically in a situation they had never experienced before.

"At first we thought there had been an explosion," said Captain Thompson. "We had been airborne about an hour and a half, and were five or six minutes into our low level TFR run. We first heard a loud bang as bits and pieces started flying past. Vic and I both ducked below the glare shield."

When things settled down, they looked up, but couldn't see out the front of the aircraft. The right windscreen was shattered and the left one smeared. Captain Thompson looked out the left canopy and ensured that they were still flying straight and level, paddled off the TFR, and then began a climbing turn to the left.

Both the tape and standby airspeed indicators were reading zero. The angle of attack indicator was moving between plus 25 degrees and minus 10 degrees. In addition, the stall warning horn and rudder pedal shaker were cycling off and on.

They swept the wings forward to 16 degrees and lowered the flaps and slats. When the slats were extended, however, the plane yawed hard left. The yaw stopped when the slats were retracted.

They leveled off at 13,000 feet and had a chance to survey the damage and try to find the cause. It was obvious that the smear on the canopy was blood, and that a birdstrike had occurred.

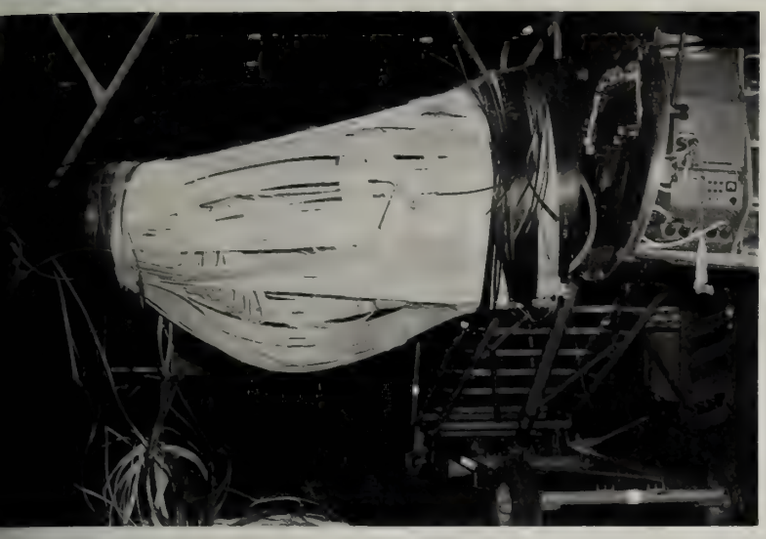
"Captain Thompson had stressed the possibility of a birdstrike during a low level run," Lt Sorlie said. "I thought about an immediate ejection, but after looking at the flight instruments and out the other wide window, I could see that J. D. had the aircraft under control."

They now saw that both glass layers of the right windscreen were shattered and a 16-inch section in the front and on the right side of the windscreen was separated from the frame.

"I don't know. I think we would have had to eject if the windscreen had failed," noted Captain Thompson. "I locked my shoulder harness, but Vic couldn't since he was keeping his head down in case the screen did fail."

Lt Sorlie added, "The situation wasn't helped any by the noise in the cockpit. We had the intercom up all the way, but it was still hard to hear what J. D. was saying."

While they were climbing, they broadcast an emergency call on Guard. Two other F-111s from the base were in the area and answered the call. It took Captain Don Holley



Left, "I have never seen an F-111 damaged to the extent J.D.'s was . . ." Lt Vic Sorlie and Capt Jim Thompson stand in front of their F-111 after a successful landing. A bird strike collapsed the fiberglass radome. Above, this is what an F-111 radome looks like after being hit by a Golden Eagle at 480 knots.



F-111 right windscreen was shattered and a sixteen inch segment separated from the air frame.

and Captain Milt Deerr flying lead in the two-ship flight twenty minutes to reach the stricken ship.

"When I first saw the plane, it looked like an F-111 with a ball of spaghetti wrapped around the nose," said Captain Don Holley. "It was the collapsed fiberglass radome. I have never seen an airborne F-111 damaged to the extent of J. D.'s. In Southeast Asia I saw one with four feet chopped off the wing. J. D. did a super job bringing the plane home."

As they approached the base, one of the other aircraft went ahead to check the weather. The other two dumped fuel to 10,000 pounds, lowered gear, and changed lead. Captain Holley and Captain Deerr were now tasked to lead the damaged aircraft for an approach.

The windscreen again became an item of concern since the changing airflow from lowering the flaps might cause it to fail. With this in mind, they decided to land straightin without further configuration changes. The rudder authority switch was placed in the full position, and an uneventful touchdown was made at 190 knots.

On the ground, the crew and wing flying safety officer reconstructed what had happened. A large bird, later identified by the Smithsonian Institute as a golden eagle, struck the radome about a yard forward of where it is attached to the fuselage. The impact crushed the top of the radome, causing it to fold back over the nose of the plane. This also caused the failure of the pitot pressure system. The pitot boom shattered both glass layers in the right windscreen, and separated from the aircraft.

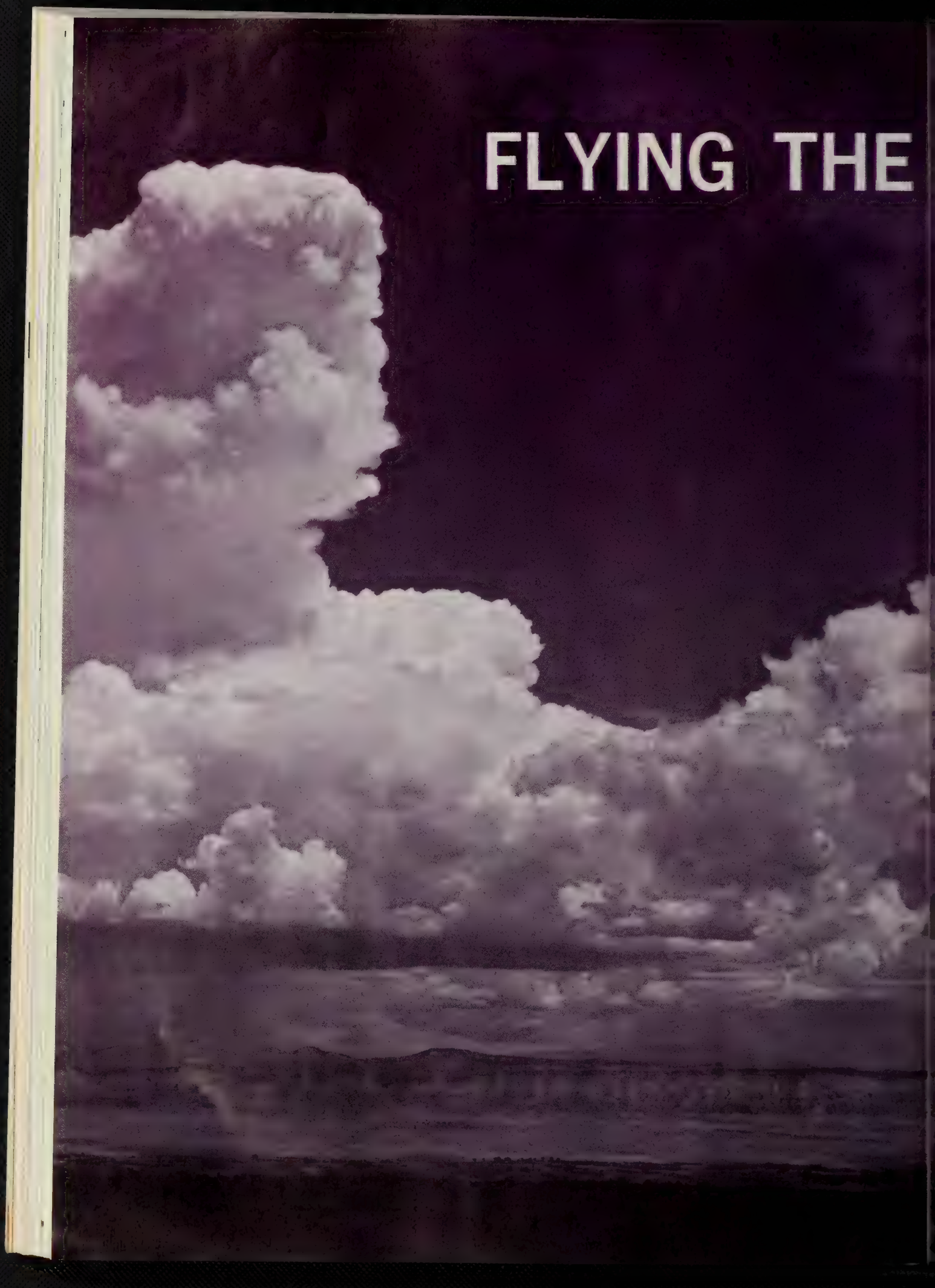
All equipment attached to the forward bulkhead was damaged and pieces of fiberglass were in both engine intakes. There was no evidence of damage to the bulkhead or any structural members.

What can be learned from this incident? First, in a birdstrike, there are no winners. Second, pilots can and must react automatically to an emergency. Lt Sorlie considered ejection since loss of a windscreen from a birdstrike normally leads to an ejection. He didn't because the IP had things under control.

It was later found that, if ejection had been attempted right after the birdstrike, the capsule would have functioned in the low speed mode, due to the damage to the pitot static system. At the speed they were moving, 480 knots, the parachute would probably have received severe damage or failed completely.

F-111 birdstrikes are normally with local predatory birds, such as hawks and eagles; not with migrating game birds. The aircraft is designed to fly low and fast and crews must receive training flying low and fast; however, lower altitudes increase the birdstrike potential.

As long as birds and aircraft fly in the same airspace there will be danger of birdstrikes, but with this crew's experience you can be better prepared for the unexpected. ★


FLYING THE

THUNDERSTORM

MAJOR HERBERT WEIGL, JR.
Air Weather Service
Scott AFB, IL

A familiar scene is being repeated right this minute at an Air Weather Service briefing counter. A forecaster is telling a pilot, "I am giving you isolated thunderstorms along the route, tops to 37K. The Radar Summary Chart shows they are building, but you should be able to go around visually."

There's nothing really new here; thunderstorms aren't uncommon. During the spring, summer, and fall, your chances of seeing one on a flight outside the local area are almost 100 percent. In recognition of this, a lot of material has been published concerning mandatory separation distances, techniques to use if you accidentally stumble into one, and always warnings about updrafts, downdrafts, tornadoes and hail.

Unfortunately, the USAF hasn't shown a dramatic decrease in the number or severity of encounters with cumulonimbus (Cbs) over the past several years. Last year 106 mishaps were recorded in the USAF. Types of aircraft involved included everything from C-5s to A-37s. Damage ranged from burnt radomes to major accidents. This year history will probably repeat itself, unless every supervisor (yes, supervisor, since they often have the opportunity to prevent the accident before the mission is launched) and crewmember personally ensures that he won't become the victim of cumulobumpus. Let's take a look at some "news you can use" to understand and avoid the thunderstorm and its associated hazards.

The best way to approach any adversary is with foreknowledge of its arsenal of weapons and tactics. Foreknowledge about thunderstorms can be placed into three categories:

a. Theoretical knowledge about thunderstorm structure.

b. Forecasts and observations telling where thunderstorms are expected to develop or have developed.

c. Tools available to the en route airman such as weather radar, Pilot-to-Metro Service (PMSV), and penetration techniques.

THUNDERSTORM STRUCTURE

Thunderstorm structure or dynamics is classically described in terms of vertical motions. Vertical motions are also used to define the three classical stages of a thunderstorm's life cycle: the cumulus stage, the mature stage, and the dissipating stage. The cumulus stage has updrafts throughout the cloud, the mature stage (marked by the onset of precipitation) has both an updraft and a downdraft, and the dissipating stage has downdrafts throughout the cloud. This cycle describes a single-cell storm (most "thunderstorm clouds" contain several cells separated by areas of relatively stagnant air) and probably exists only in widely-separated "air mass" thunder storms. Figure 1 shows a moderate single-cell thunderstorm in the mature stage.

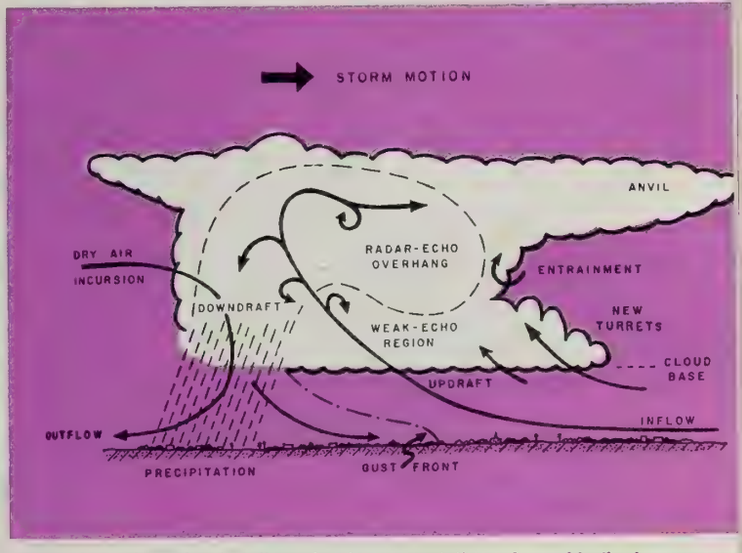


Figure 1. Schematic, two-dimensional representation of an idealized storm structure showing cloud outline, mean streamlines, and echo contour (dashed). (From NHRE Project Plan 1975-1980.)

Thunderstorms that are part of organized systems (lines or areas) consist of cells that develop and dissipate one after the other, so that the line or area can maintain its recognizable identity for several hours as they track over several hundred miles. The thunderstorms associated with organized systems are frequently larger and more intense than air mass thunderstorms. These storms are much more likely to produce hail and tornadoes than other thunderstorms. Hail



has been reported in "clear" air as far as 14 NM from these giants. These "steady-state" storms, recognizable by their size, persistence, frequent lightning, and strong radar return, are to be avoided by at least 20 NM horizontally. Most of us can forget about topping such storms, for they often reach 60,000 feet above sea level, or higher. Some MAJCOMs have supplemented AFR 60-16, General Flight Rules, with thunderstorm horizontal-clearance criteria.

FOREWARNED IS FOREARMED

Once the dynamics (armament and tactics) of the thunderstorm are understood, its location becomes the most critical element of information. The forecaster has a great deal of data with which to predict cb's whereabouts. He has observations that tell, with good accuracy, where thunderstorms are currently located, and he has various tools to predict future thunderstorm location. Military Weather Advisories (MWAs) prepared by the Air Force Global Weather Central (AFGWC) within the CONUS and designated AWS centralized units overseas are one of the best of these forecaster tools. The MWAs identify areas with potential for thunderstorm development, and provide forecasts of thunderstorm intensity and areal coverage. Areal coverage is expressed in terms of maximum instantaneous coverage (MIC) (the maximum percentage of the area actually experiencing a thunderstorm at a given time) and the total area affected (TAA). Thunderstorm dynamics require some free space around developed storms. A reasonable upper limit for the MIC of a large area is 15 to 20 percent of the TAA.

Forecasters translate MICs and TAAs into the terms isolated (1-2 percent), few (3-15 per cent) scattered (16-45 percent), and numerous (more than 45 percent) listed on the DD Form 175-1, Flight Weather Briefing. The percentages entered on the DD Form 175-1 relate to the specific route of flight. For example, an aircraft penetrating a line of thunderstorms 100 NM long and 10 NM wide at right angles will encounter relatively few thunderstorms while another aircraft parelleling this line will encounter many thunderstorms. The briefer might mark the DD Form 175-1 for the first aircraft as shown in Figure 2.

The second aircraft's DD Form 175-1 might be marked as shown in Figure 3.

If the thunderstorms were widespread air mass thunderstorms in Western Illinois and Missouri instead of the line illustrated earlier, the briefer might mark the DD Form 175-1 as shown in Figure 4.

One further point to remember about thunderstorm forecasts for operational flight briefing is that thunderstorms are entered on DD Forms 175-1 when expected within 10 NM either side of the route and location for

THUNDERSTORMS				TURBULENCE			
MWA NO. 12				CAT ADVISORY		Z	NONE
	NONE	AREA	LINE		NONE	IN CLEAR	IN CLOUD
	ISOLATED 1-2%			LIGHT			TRACE
✓	FEW 3-15%			MOD			LIGHT
	SCATTERED 16-45%			SVR			MOD
	NUMEROUS-MORE THAN 45%			EXTREME			SVR
HAIL, SVR. TURB. SEVERE. ICING. PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.				LEVELS			LEVEL
LOCATION TOY-STL				LOCATION			LOCATI

Figure 2. DD Form 175-1 entry for aircraft penetrating line of thunderstorms perpendicularly.

THUNDERSTORMS				TURBULENCE			
MWA NO. 12				CAT ADVISORY		Z	NONE
	NONE	AREA	✓ LINE		NONE	IN CLEAR	IN CLOUD
	ISOLATED 1-2%			LIGHT			TRACE
	FEW 3-15%			MOD			LIGHT
	SCATTERED 16-45%			SVR			MOD
✓	NUMEROUS-MORE THAN 45%			EXTREME			SVR
HAIL, SVR. TURB. SEVERE. ICING. PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.				LEVELS			LEVELS
LOCATION TOY-CGI				LOCATION			LOCAT

Figure 3. DD Form 175-1 entry for aircraft paralleling a line of thunderstorms.

THUNDERSTORMS				TURBULENCE			
MWA NO. 12				CAT ADVISORY		Z	NONE
	NONE	✓ AREA	LINE		NONE	IN CLEAR	IN CLOUD
	ISOLATED 1-2%			LIGHT			TRACE
✓	FEW 3-15%			MOD			LIGHT
	SCATTERED 16-45%			SVR			MOD
	NUMEROUS-MORE THAN 45%			EXTREME			SVR
HAIL, SVR. TURB. SEVERE. ICING. PRECIPITATION AND LIGHTNING EXPECTED IN AND NEAR TSTMS.				LEVELS			LEVELS
LOCATION WRN IL & MO				LOCATION			LOCATION

Figure 4. DD Form 175-1 entry for aircraft transiting large area of widespread thunderstorm.

helicopters and within 50 NM either side of the route and location for fixed-wing aircraft.

Before leaving the weather station, aircrews should get the latest weather radar information if thunderstorms are forecast or observed near the departure airfield. The crew should know the location of existing thunderstorms in relation to the route of flight, whether the storms are developing or dissipating, whether the storms are part of an organized line, and the storms' movement and velocity. The forecaster will already have briefed on any pilot weather reports (PIREPs) relayed from other airmen already tangling with the weather.

CONFRONTATION

Before initiating the takeoff roll, a quick check with the briefer on PMSV to check further developments on the local and/or en route thunderstorms is advisable.

Airborne, the pilot should not attempt to operate into areas of known or forecast thunderstorms without an operational airborne radar capable of detecting the thunderstorms, unless the flight can be conducted through the area visually. Air traffic control (ATC) agencies such as Air Route Traffic Control Centers (ARTCCs) and Radar Approach Controls (RAPCONs) can and will, workload permitting, provide assistance for thunderstorms upon request. En route PMSV stations can also be used to update the airman's data base about thunderstorm development, location, and movement. PIREPs transmitted to ARTCCs, RAPCONs, and PMSVs about thunderstorms are very valuable to other pilots and forecasters; so, please transmit PIREPs whenever possible. Figure 5 shows two possible routings around a broken line of thunderstorms.

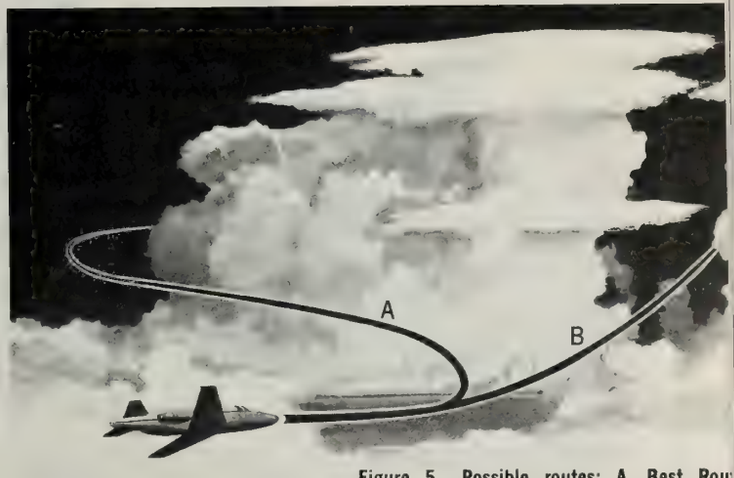


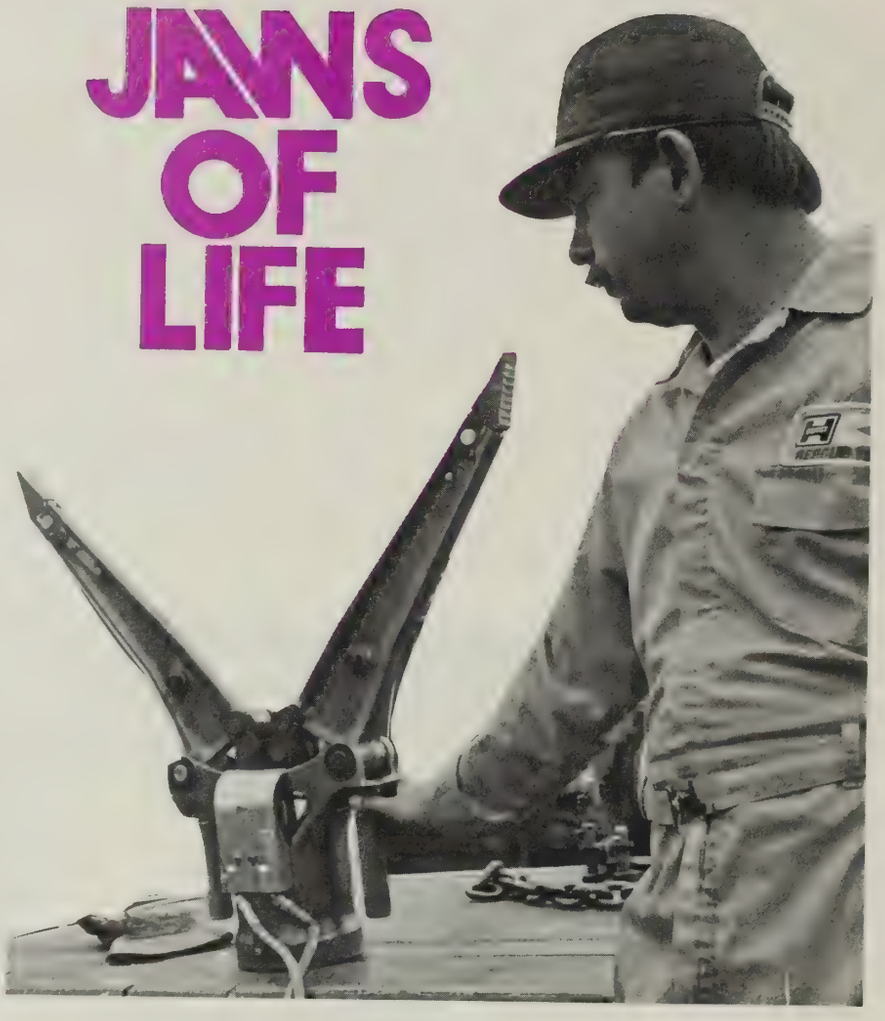
Figure 5. Possible routes: A. Best Rou avoid the storms by at least 20 NM. B. W A. is not feasible, fly VMC between cbs heavy shower areas.

Route B should be attempted only if the aircraft can maintain 20 NM separation from all thunderstorms.

EPILOG

In this era of austerity (the Air Force has fewer aircraft now than any time since the 1930's), we must ensure that our aircraft are not disabled or lost for any reason, particularly one as common as thunderstorms. By applying what is known about thunderstorm structure, forecasts and observations available at preflight briefings and while en route, and penetration techniques appropriate to the aircraft, aircrews can make a significant contribution to resource protection. All those involved with professionally completing a mission through or near thunderstorms without incident (aircrews, meteorologists, ATC personnel and supervisors) can draw satisfaction from safely completing a difficult and inherently dangerous task. ★

JAWS OF LIFE



THE FAST SAFE WAY TO FREE TRAPPED VICTIMS



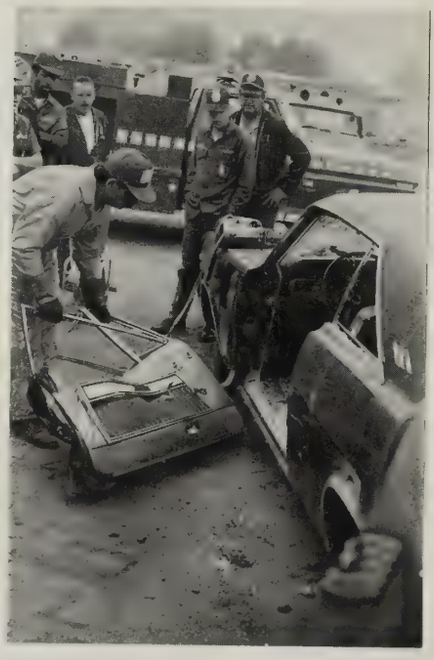
If you should find yourself trapped in a wrecked aircraft or car, don't give up hope. Warner Robins ALC has approved a power rescue tool for inclusion in applicable TAs.

What this means is that USAF fire departments may now acquire the Hurst Power Rescue Tool, known as the "Jaws of Life", a device that has been used in hundreds of civil rescue operations in all parts of the country. Since the Norton AFB fire department is scheduled to get one of the tools, we arranged for a demonstration by the manufacturer. Here are the details.

The tool is a high powered, self-contained spreading and pulling device, hydraulicly operated, flameless and free of spinning blades or wheels (photo 1). It operates with maximum output of 10,000 pounds of force at the tips of the jaws. The tool weighs 55 pounds and its gasoline engine weighs 40 pounds. The arms measure 32 inches when fully open.

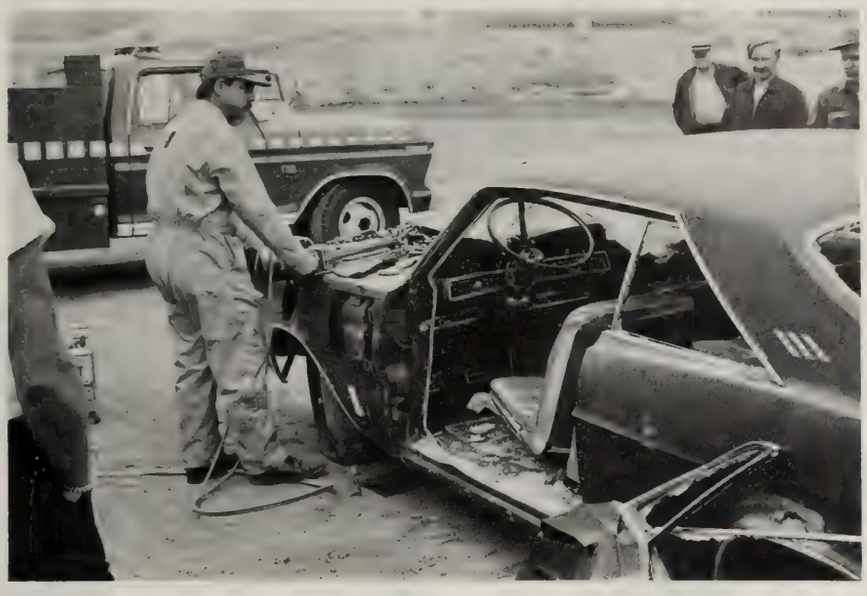
A salvaged 2 dr hardtop was used for the demonstration. To gain access to the rear section, the tool jaws were placed between the roof and inside face of the side panel. A push





This rescue tool has multiple uses in military, industrial, and commercial environments. It can be instantly customized to spread, cut, slit, shear or pierce.







on the trigger and the jaws spread, enabling rescue within a couple of minutes. When a person is trapped behind the steering column, the column and wheel are pulled forward, toward the windshield. One chain and slip hook are attached to the bumper support; another chain is wrapped around the bent steering column and slip-hooked. With the rescue tool jaws in an "open" position, the other ends of both chains are attached to grab hook assemblies that are installed on the arms of the rescue tool. Push the trigger. The jaws close and pull the steering column forward to release the victim.

There are simple adapters to the Hurst Power Rescue Tool to be used in rescue of persons from aircraft. The tool can chew away fuselage skin and bulkheads for rapid access to pilot or crew member. A very impressive adapter is the power shears, which have a cutting force of 8000 pounds and are able to cut the corner post of a car, after which the top can be removed for access.

The Navy has used the rescue tool and found a new application—as a jack to raise the nose gear so that a portable dolly can be installed to remove disabled aircraft from the runway.

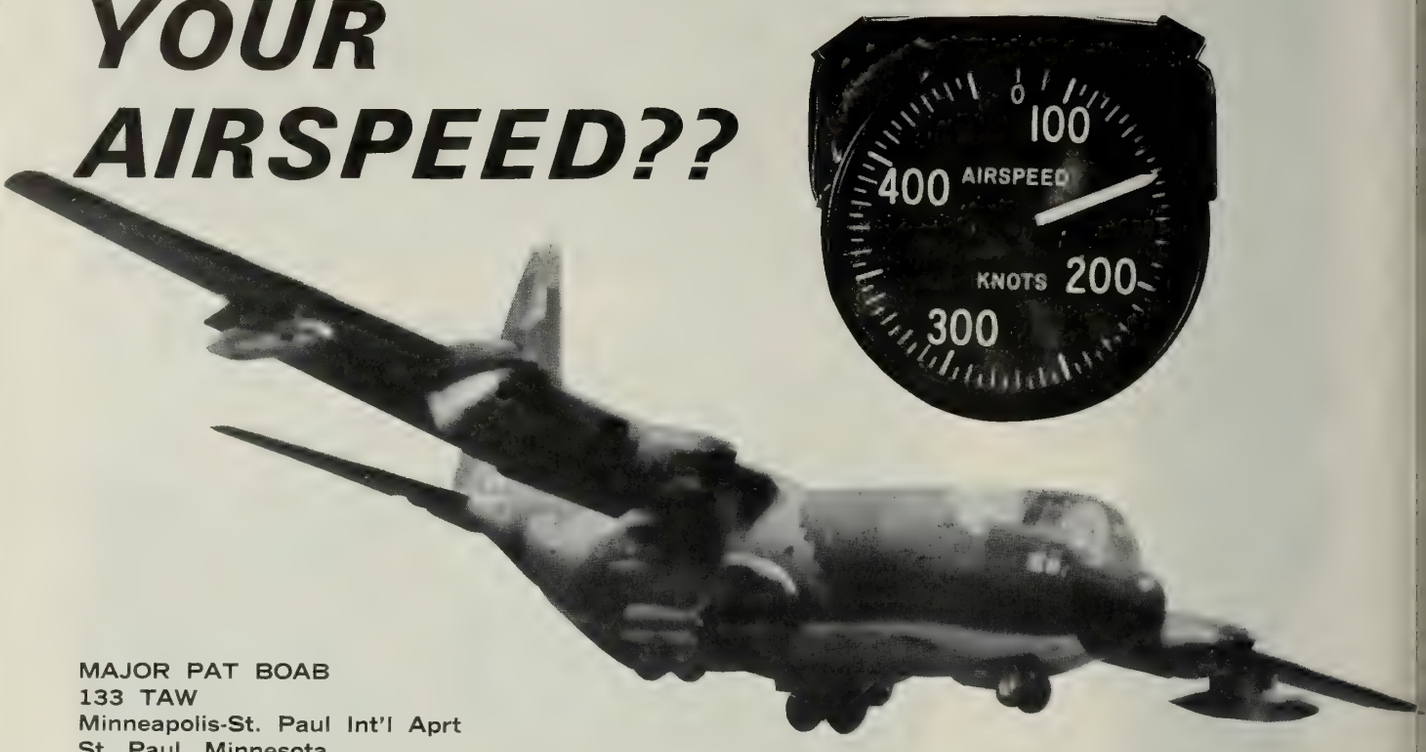
Tests by the Air Force determined that the five leaf rear springs on P-10 fire trucks will be replaced with eight leaf springs. This will allow a payload increase of approximately 500 pounds, which will provide for the additional weight of the tool and engine installation.

The tool operates without flames, grinding sparks or mechanical cutting. It is portable and can be hand held and operated by one man. ★

TABLE

Tool :	6½" x 14½" x 31" Arms fully opened: to 32" Weight: 55 lbs.
Engine:	Gasoline—40 lbs. DC Electric—55 lbs. AC Electric—65 lbs.
Chains:	6' overall length, each.

IF YOU CAN'T *TRUST YOUR AIRSPEED??*



MAJOR PAT BOAB
133 TAW
Minneapolis-St. Paul Int'l Aprt
St. Paul, Minnesota

A C-130 returning from a training mission climbed through a cloud layer to VFR conditions. Upon level-off, the pilot's and copilot's airspeed indicators differed by 50 knots, decreasing to a 20-knot discrepancy on approach. An uneventful landing was made.

During climb from FL 350 to FL 390 to avoid turbulence, the airspeed of a four-engine airliner started to increase. Although power was retarded, the increase in airspeed continued. Power was retarded to idle, airspeed indicators were at barber pole, and mach meters read M.88. Buffeting occurred, a descent was made, and airspeed decreased. The aircraft was flown using power and pitch, and a landing was made with the benefit of a chase plane.

After a normal takeoff, another four-engine airliner had a decrease in airspeed to 140 knots at 400 feet, causing some concern as V_2 was 153 knots. Lowering pitch caused the airspeed to increase to 150 knots. At this time, the altimeters were reading 200 feet below field elevation! Takeoff attitude was reestablished, and both airspeeds dropped to zero; the altimeters remained below field elevation. Climbing to VFR conditions, the aircraft proceeded to an airfield where VFR conditions prevailed, and a landing was made without further incident.

A three-engine airliner was not as lucky. As the aircraft passed through 16,000 feet, during climb, indicated airspeed began to increase above normal for the climb attitude of the aircraft. Thinking they were in some sort of updraft, the crew attempted to reduce airspeed by increasing pitch attitude. At 24,000 feet, both overspeed warning clackers sounded, followed by buffeting and a stick shaker. In an attempt to remain below barber pole speed, power was reduced to idle. The aircraft stalled and crashed, killing all on board.

A common theme underlies all of these incidents—there was some malfunction in the pitot static instruments, probably caused by icing

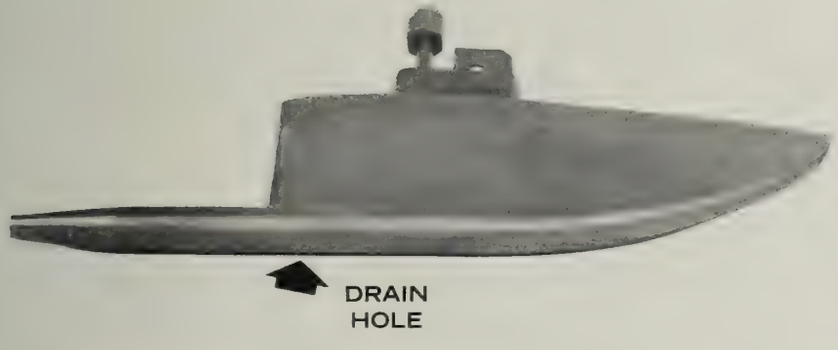
beyond the capabilities of the system, water in the lines, pitot heat switch malfunctions, heater failure, pitot heat switches left off, or perhaps because static sources were frozen over or blocked. You might also get similar indications with a CADC malfunction, if your aircraft has a CADC. For whatever reason, there was an element of surprise in some of these cases.

Almost any pilot will tell you that if the pitot static system ices over, airspeed would indicate low or zero; however, very few remember that under certain circumstances airspeed can increase as altitude increases when the pitot system is blocked.

Most pilots feel, within reason, that lots of airspeed is good and that low airspeed is bad. The most insidious type of pitot static system malfunction is one where airspeed increases as altitude increases. How does this seemingly inconsistent indication occur?

Close examination of pitot tubes will reveal a small drain hole. This hole allows atmospheric moisture to drain out of the pitot system during flight. If this hole freezes before the inlet hole freezes, and then the inlet hole freezes over instantaneously, total pressure is trapped in the system. This total pressure is the dynamic pressure that was being rammed into the pitot tube, plus the static pressure existing at the altitude the aircraft was maintaining. When this happens, the airspeed indicator acts like an altimeter. When altitude is increased, static pressure decreases and the airspeed indication increases. Of course, the reverse is true when altitude decreases. The result of both inlet and drain hole freeze-up can be disastrous.

If you suspect a pitot static system problem what alternative sources of airspeed and altitude information might you have? Probably the best performance information is an angle of attach indicator; doppler ground speed is valuable; some approach control radars have a ground speed readout on the scope; center may be able to provide ground speed information. A chase plane, if available, is a valuable input. There are also more indirect clues available such as power versus pitch information. To use this information, some people don't change the ADI setting during flight. This way they'll have a reference pitch attitude which, along with a known power setting, will give them the desired airspeed.



During every pilot's preflight or walkaround inspect the pitot tube drain holes for obstruction to prevent airspeed malfunction.

Rough altitude information may be available on the cabin altimeter if you depressurize, but be careful of the instrument lag, especially if you are descending. Also, many cabin altimeters are grossly inaccurate when compared to the tolerance of the primary cockpit altimeter. A radar altimeter can be helpful in maintaining a safe height above the ground. Power and pitch can be used to attain a climb attitude and obtain a safe altitude.

So where does all this leave us? Most important, if your pitot-static instruments begin to look funny to you, *assume* you have a problem. These failures are sometimes very difficult to detect. Your natural instincts may be exactly the wrong thing to do, and if you continue doing it long enough you may not be able to recover.

1. Turn the pitot heat ON—if it's on, recheck the circuit breakers are not popped .

2. Set a known power setting for your aircraft.

3. Use a pitch attitude which you know should give you the desired performance, either climb, descent, or level flight.

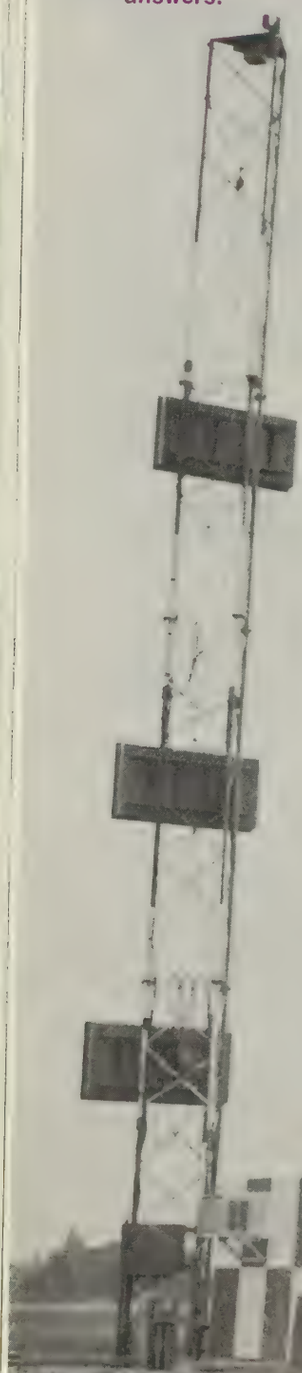
4. Cross-check angle of attack indications.

This should get you under control, but it's not over yet. Check your CADC if you have one. Swallow your pride and call for help. Get into VFR conditions if at all possible. Ask your wingman or a radar control agency for a check on your speed. If you use an ATC agency's speed on your Doppler speed, remember that the pilot's reference for flying the aircraft is *indicated* airspeed; you'll have to plug in a wind component with this ground speed. Angle of attack can assist here.

And, lastly, don't try cracking any serious weather if you have any doubts about your instruments. ★

THE IFC APPROACH

When a pilot receives a clearance or instructions from a controller, it is imperative that he understand what he is expected to do. In addition, he should know what services to expect from the controller. References follow most answers.



Q: When the controller states, "Radar contact," is he providing me with obstacle clearance?

A: No. "Radar contact" is the term an air traffic controller uses to inform a pilot that his aircraft is identified by radar and radar service is available if requested. The pilot, upon receipt of "Radar contact," will automatically discontinue making position reports over compulsory reporting points. (FLIP, General Planning, Chapter 2)

Q: I am on an IFR clearance and receive radar vectors. What obstacle clearance am I being provided?

A: The minimum radar vectoring altitude assigned by the air traffic controller will assure you of a 3 nautical mile lateral separation (5NM if the obstruction is beyond 40NM from the radar antenna) and/or 1000 foot altitude separation from any obstruction until you are established on a segment of a published route or instrument approach procedure. Since the minimum radar vectoring altitude may be below the minimum safe/sector altitude or emergency safe altitude as published on the approach chart, it is essential that the pilot know the applicable minimum altitude for use in the event of lost communication. (Federal Aviation Administration Handbook (FAAH) 7110.8D, para 1333)

Q: I am on a VFR clearance and receive radar vectors. What obstacle clearance am I being provided?

A: It is the responsibility of the pilot to provide his own obstacle clearance. A VFR aircraft may be vectored without being assigned an altitude. It is also the pilot's responsibility to comply with any applicable rules, i.e., visual flight rules, minimum altitudes, visibility requirements, etc. (FAAH 7110.9D, para 687)

Q: With an IFR flight plan, off airways in uncontrolled airspace, who is providing obstacle clearance?

A: The pilot will ensure the aircraft is flown at least 1000 feet (2000 feet in mountainous terrain) above the highest obstacle within 22NM of the intended route. (AFR 60-16, Chapter 8)

Q: Is the controller responsible for assuring that an assigned altitude provides obstacle clearance?

A: Yes; however, the pilot must be alert for inadvertent unsafe clearances. (FAAH 7110.8D, para 791)



By the USAF Instrument Flight Center
Randolph AFB, Texas 78146

Q: When the controller issues a cruise clearance, who is responsible for obstacle clearance?

A: The controller, with respect to assuring that the cruise altitude assigned meets obstacle clearance requirements; the pilot, with respect to operation at altitudes below the assigned cruise altitude. (FAAH 7110.8D, para 23, 783, 791)

Q: I recently flew a circling approach from a surveillance radar approach and received the MDA for a straight-in from the controller. Why didn't he give me the circling MDA?

A: The controller's handbook instructs the controller to issue the straight-in minimums. He will issue the circling MDA *if requested by the pilot.* When requesting the circling MDA, furnish the controller with the aircraft category used to circle. (FAAH 7110.8D, para 1472; FLIP, General Planning, Chapter 9)

Q: Is the circling MDA for a surveillance radar approach the same as the circling MDA for an approach which utilizes a navigation aid, e.g., VOR, TACAN, etc.?

A: The MDAs may be different. The specific criteria used to determine the size and shape of each area for computing the obstacle clearance altitude may be different. Therefore, if circling to land at the completion of an ASR approach, use the appropriate circling MDA as listed in the IFR Supplement. Likewise, if circling to land from an approach procedure published in a high or low IAP booklet, use the appropriate circling MDA as published on that procedure. (AFM 55-9, para 260, 322)

Q: At an Air Force base, can I expect to receive a clearance to circle to land from a PAR approach?

A: No. There are no established procedures for providing radar glide path information to an aircraft making an approach to one runway and circling to land on another runway. The azimuth portion of the PAR may be used to provide a surveillance radar approach to one runway, circle to land on another runway. (AFCS Air Traffic Control Digest, Dec. 1972 issue)

Q: If the primary radar (skin paint) has failed for an ASR facility, can I receive a surveillance radar approach using only secondary radar (transponder)?

A: Yes. If an emergency exists and the pilot concurs, the secondary radar may be used to provide final approach guidance. (FAAH 7110.8D, para 1153)

Q: Does PAR equipment have the capability to receive secondary radar (transponder) returns?

A: No, PAR is skin paint only. *Instrument flying procedures are written by pilots for pilots. If you would like to help us improve them, call us at AUTOVON 487-4276 (Pilot Procedures), 4274 (TERPS), 4884 (FLIP).* ★



OPS TOPICS

HASTE MAKES A TAXI INCIDENT



When the C-141 taxied to the active, the crew found the runway access partially blocked by some fighters. The tower advised the '141 crew that there would be about 10 minutes delay unless there was room to taxi past the fighters. The aircraft commander elected to do so. The right main left the hard surface and became mired axle-deep in the mud.

FLIP ERRORS

A recent issue of the High Altitude Instrument Approach Procedures had inaccurate information on several approach charts. Fortunately, the error was corrected by NOTAM before the publication effective date. There is a new procedure requiring chiefs of airfield management to review their local charts for errors. But the pilots can help, too. If you know of an error or inconsistency in an approach procedure or believe there is some hazard, *tell* somebody—please!

MIDAIR?



The F-105 formation was scheduled for a 1000 AGL fly-by. As the flight was descending to altitude and lining up on track, the leader was paying more attention to the formation than the altitude. Just before impact he saw the radio tower. Fortunately he was able to make a safe recovery. At fly-by altitude the tower clearance should have been about *750* feet.

F-4 SAFETY SUPPLEMENT



There is a new safety supplement about F-4 BLC malfunctions. Among other things, it reminds aircrews to consider jettisoning external stores prior to gear lowering.

CHECKLIST IS RIGHT



When the T-39 pilot raised the gear after takeoff, there was a loud bang. The gear fell back to the down and locked position and the normal hydraulic pressure indicated zero. The pilot turned on the auxiliary hydraulic pressure switch to check accumulator pressure. The aux system then went to zero, so the crew accomplished the hydraulic failure procedures and made a safe landing. The forward cap of the right speed brake actuator had cracked and allowed the hydraulic fluid to be discharged overboard. If the pilot had followed the emergency procedures checklist, he would not have lost aux hydraulic power, since previous steps in the checklist would have isolated the speed brake system. Although the pilot had no way of knowing that the leak was in the speed brake, following the checklist would have been a good idea.

NO MORE VFR (FLIGHT PLANS)

The FAA has proposed the elimination of their VFR flight plan service for most operations. This proposal is made since emergency locator transmitters (ELTs), which are required on most aircraft, have made VFR flight following unnecessary. The flight following will be continued for flights over lakes, swamps and mountains. This proposal has been advocated by AOPA and GAMA.

OPS TOPICS

BENDS



The T-37 had been cruising at FL240. After about an hour one of the pilots began to feel "uncomfortable." This feeling persisted until approximately 30 minutes after landing. The flight surgeon diagnosed the problem as a slight case of the bends. The aircraft was never above FL250.

YOU'VE GOT IT! I'VE GOT IT! WE'VE HAD IT.



The new KC-135 copilot was having some difficulty on final approach with lateral control instability. During the flare the left wing was about 2-3 degrees low so the IP applied steady right aileron pressure to level the wings. The copilot then realized the left wing was low and applied full right aileron. This caused a rapid right wing drop and despite immediate left aileron correction by the IP, nr 4 engine struck the runway, causing over $4000 damage.

NO GAS!



The Air Force is phasing out its recip support aircraft. As a result, many bases no longer have a requirement for AVGAS. These bases are discontinuing stockage and issue of AVGAS. So before you go to any base in a machine that requires AVGAS, check the NOTAMS and IFR Supplement.

HOW LONG?



Recently a T-38 flamed out while taxiing in from a mission. There was a fuel indicator malfunction yet the IP flew an entire mission without keeping track of his airborne time. After the engine flamed out there were only 5 gallons remaining in the system for that engine. Crossfeed was never used.

KNOW YOUR POSITION



The transport was making an enroute descent to a base in mountainous terrain. While on radar vectors, passing 12,000 feet, flight was cleared by the controller to 8000. At this time they were within 13 miles of an 8900' plus peak. Just as they were passing 9000 feet the controller asked the aircrew to confirm their position and then told them to level at 10,000. When the crew told him they were passing 9000 he told them to maintain 9. When questioned, the controller acknowledged that he had a 10 mile error in his scope. (He could not accurately determine the plane's position.) Fortunately the flight was VMC throughout the descent.

WRONG TIRE

A T-38 tire failure has been attributed to the wrong size tire. The one that failed is rated to only 139 knots. If you go to a strange base and need a tire change, be sure that you get the right kind. If in doubt, check the TO or your home maintenance troops.

ANNUAL AIRLIFT REUNION

September 26-28, 1975, 7th Annual Airlift Reunion, New Orleans Marriott Hotel, New Orleans, Louisiana. For details, write: 7th Annual Airlift Reunion, Box 1176, Jacksonville, Ark. 72076, or call Reunion Project Officer, Col Earl C. Schmeling, Phone: 1-501-988-3744.

FUEL-VAPOR EXPLOSIVE AND FIRE HAZARDS

GUS S. ECONOMY
Directorate of Aerospace Safety



Mixtures of flammable vapors and air are hazardous and require serious consideration when planning for maintenance tasks or aircraft operational support procedures. I am convinced certain accidents would not have occurred if the hazardous properties of flammable vapor-air mixtures were recognized and acted upon accordingly. For this reason, an understanding of the "flammability/explosive range" and an appreciation of the mechanism of fuel-vapor fires and explosions are important.

For a fire or explosion to take place, three necessary elements must be present: (1) combustible material (fuel); (2) oxygen; (3) ignition. This is referred to as the fire triangle. When considering fire or explosion within a vapor mixture, a fourth element is necesary: correct proportion of fuel and oxygen. This proportion is known as the "explosive range" of the mixture.

The terms "lower" and "upper flammability limits" (LFL and UFL) or "lower" and "upper explosive limits" (LEL and UEL) are used interchangeably to indicate the lowest and highest concentration of the fuel by *volume percent* in air at standard temperature and pressure which, upon ignition, is capable of sustaining combustion and/or exploding.

LEL and UEL are readily visualized if we think of the propagation of flame in a combustible mixture as the result of the transfer of energy (heat) from one layer of gas to the next. The LEL is the *lowest concentration* of flammable vapor in air that is capable of transmitting flame throughout the entire mixture. If the flammable vapor is diluted with such an excess of air that the heat released upon ignition is insufficient to raise the temperature of adjacent layers of gas to the ignition point, the flame may not travel throughout the mixture

The UEL is the *maximum concentration* of vapor in air that can

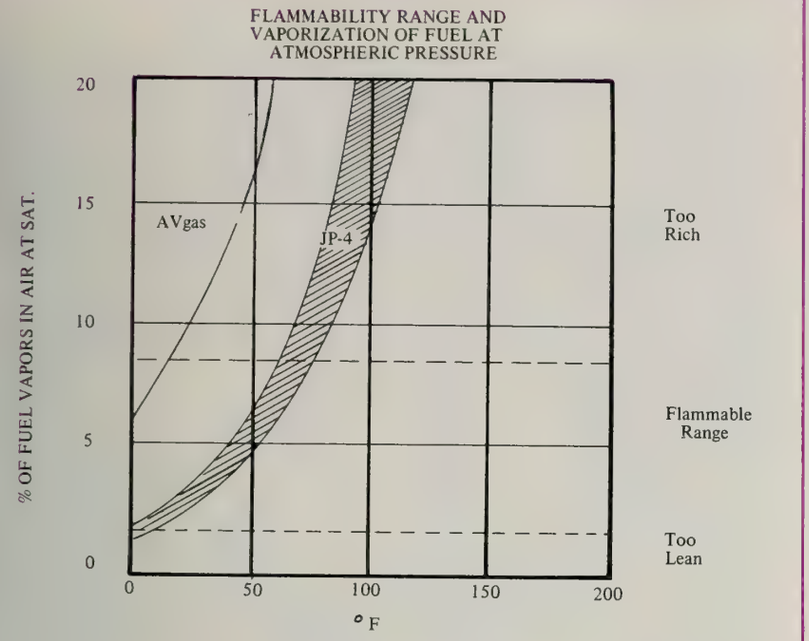


Figure One

propagate a flame. If there is more fuel vapor present than can react with the available oxygen, the mixture is too "rich." The sketch in Figure 1 illustrates the fuel-air balance necessary for combustion and propagation.

To illustrate, visualize an open-end tube of uniform diameter and of any length. Assume a constant pressure within the tube and uniform temperature. Visualize within the tube many uniform, thin layers of any flammable air-fuel mixture whose proportions are within the LEL and UEL. The minimum temperature (T_1) is the temperature within the lean limit range. (As an example, JP-4 is -20° to 20° F (min) to 60° to 100° F (max).) A spark plug, as the ignition source, is inserted into the left side of the tube. The spark will ignite the first layer which will burn until the interface of the first and second layers reaches a maximum temperature (T_2) which then ignites the second layer. This process continues from the second layer to third, fourth, and so on. If the pressures and temperatures remain constant, the vapors in each layer will burn and travel at a comparatively slow rate. Unfortunately, in most cases the flame velocity rate increases to the point of detonation which results in catastrophic accidents, i.e., fuel cell or storage tank rupture. Further on in this article, an explanation of this phenomenon is summarized.

Explosive limits (high and low) vary greatly. In some cases, the limits with air are relatively narrow and the explosive mixtures can be easily avoided. In other cases, limits are so widespread that only mixtures of extreme leanness or richness are outside the explosive range. (The explosive range limits for various fuels are shown in Table 1.) For example, hydrazine (a missile fuel) has an explosive range of 4.7 to 100 per cent by volume. The explosive range of JP-4 is (approximately) 1.3 to 8.2 percent by volume.

Let's consider the *flash point* of a combustible vapor-air mixture to the explosive range of that mixture. The "flash point" temperature is

Table One

FLAMMABILITY LIMITS FOR COMBUSTIBLE MIXTURES

FUELS	*AIT °F	Flash Point of Open Cup	Flammability Limits Volume % and (°F) Lower	Upper	Temperature Range for Explosive Mixtures °F Lean	Rich
JP-4	468	Very Low	1.3(75)	8.2(75)	—20 to +20	60 to 100
JP-5	473	140	0.6(140)	4.5(140)	140	210 to 220
JP-6	450		0.7(212)	4.2(300)		
AV-GAS 115/145	880				—60 to —50	5 to 20
ETHANOL C_2H_2OH	700	70	3.3(68)	19(68)		
HYDRAZINE N_21+4	578	124	4.7(212)	100(212)		
UDMH $(CH_3)_2N_2H_2$	482	50	2(68)	90(68)		
ANHYDROUS AMMONIA NH_3	1204		16.1(68)	26.8(68)		

*Autogenous Ignition Temperature
Flammability Limits based at one atmospheric pressure

CONTINUED

that point at which there is sufficient evaporation to reach the LEL of the vapor-air mixture. This point is also the point when a flammable liquid and air are in equilibrium in a closed container at normal atmospheric pressure. For example, visualize a fuel tank or cell which has been standing long enough so that evaporation of all the fuel *at that ambient* temperature and *pressure* has occurred and is in a gaseous state in the ullage space. In this condition, the mixture is at its flash point.

In considering the mechanism by which a flame front accelerates to a detonation wave, certain factors must be considered which influence ordinary burning or deflagration (burning velocity less than sonic). The normal burning velocity of a flame in a combustable gaseous mixture is the *rate* at which the flame advances normally to the surface into the unburned surface. The normal burning velocity is a *function* of the initial *pressure* of the unburned mixture, as well as the *composition* of the fuel and oxidizer. Other factors do influence the burning velocity, but for simplicity of discussion the aforementioned are the primary factors.

For example, let us again assume the cylindrical tube of uniform diameter, both ends open, and filled with a gaseous mixture. When the mixture is ignited at one end of the tube, the gases *start* to burn at a comparatively slow rate. The heat released causes the temperature to rise, which, in turn generates a pressure wave that is transmitted with increasing velocity into the unburned gases. As the shock wave gains strength, the temperature of the unreacted gas behind the shock wave progressively rises causing the explosions to occur (step-wise) at a *faster rate*. In other words, one condition contributes to the other. In time (milliseconds) the step-wise pressure waves unite and reinforce each other with the subsequent formation of a shock wave. At this point the flame front is still behind the shock wave, but is gaining momentum. (Remember your high school chemistry?—"An increase in temperature or pressure will result in an increase of reaction rate.") Eventually (milliseconds) the flame front unites behind the shock wave. The combination of these two now forms the detonation (shock and flame front) wave and will propagate at a constant velocity (assuming no area perturbations).

Frequently during the buildup phase, the flame propagation rate may become greater than the detonation velocity and an overshoot or blowout occurs. This overshoot is more pronounced in lean mixtures. Usually the propagation rate does not overshoot when the combustible mixtures are fuel-rich.

If the diameter of the tube increases suddenly, the sudden expansion may destroy the detonation wave. However, it is *unlikely* that the flame will be extinguished. If the flame does continue to burn, pressure waves will again be generated. These secondary pressure waves can interact and fortify each other and progress from deflagration to detonation.

SAFETY FACTORS IN CONFINED SPACE ENTRY

Because of the extreme fire and explosive hazards which exist in vapor-fuel concentrations within the explosive range, present Air Force procedures prohibit entry into such spaces, i.e., storage tanks, aircraft fuel cells, missile tankage or other confined spaces. These procedures preclude entry into confined spaces when the fuel-vapor concentration exceeds 20 percent of the LEL. This figure has been adopted as a standard by the American Petroleum Institute, the Air Force, industry, state safety ordinances, etc.

The following Air Force documents implement the aforementioned practices:

TO 1-1-3, Preparation, Inspection and Repair of Aircraft Fuel, Oil and Water-Alcohol Cells and Integral Tanks."

TO 00-25-235, "Safety Procedures and Equipment for Confined Space Entry."

There is very good reason why the level of 20 percent of LEL was established. It is based on a safety factor (by experience) which assumes point source detection of vapor concentrations of less than 20 percent of the LEL will assure that the *overall* confined space is safe (less than LEL). Let's explain it another way. Presently used vapor detector instruments are *point* source detectors. The instrument analyzer samples and responds only to a small vapor mixture drawn in by the detector probe. It is *not* an *area detector* or a *continuing monitor scanner*. It is emphasized that the purpose of the 20 percent LEL limit is to control the overall flammability/explosion hazard. Protective clothing at this point is another significant factor and is spelled out precisely by the applicable Air Force documents. Therefore, the 20 percent LEL safety practice is a reasonable and prudent safety factor.

Let's take an example to illustrate the above. Suppose it is necesary to clean and repair a fuel tank or cell which was drained and purged according to TO procedures. The fuel involved has an LEL of 2 percent by volume. An explosimeter reading indicates that the vapor concentration inside the tank or cell is 1.5 percent by volume in air. As 20 percent of the LEL is .2 x 2 = 0.4 percent, the vapor concentration must be reduced to at least 0.4 percent before entry. This can be done by dilution with air using an Air Force approved explosive-proof blower with ducting into the confined space or *other TO directed procedures*.

A knowledgeable respect for the significance of the explosive range and compliance with TO procedures will reduce the potential of fuel-vapor fire/explosion type accidents. ★

That's the rub





Fire loop, above, starting to chafe on T-39 engine cowling. Upper left—hydraulic pump on KC-135 engine exposing hose where chafing occurs.

The word "chafe" can be defined in a number of ways. The most appropriate to this article is the one which defines it as "to rub or press with friction." Chafing, as understood by the aviation community, usually refers to a situation where two or more aircraft parts have been positioned close together and, due to engine or flight-induced vibration and flexing, the parts wear against each other. Such rubbing action can cause material to wear away to the extent that eventually, unless corrective action is taken in time, one or both parts will fail. Although chafing can be blamed on poor engineering or design, it is people-caused, either by the manufacturer or by AF maintenance personnel.

People cause chafing when they fail to correctly position a clamp, or properly torque a part into place. For example: two T-38's had fire warning lights illuminate and had to make single engine landings. Both incidents were the result of chafing. On one aircraft, the afterburner control cable came in contact with the fire loop. On the other, the fire detector cable shorted in the boattail section.

During flight, the right engine fire warning light on a T-39 came on. Both fire extinguishers were discharged and the fire light went out. A single engine landing was made and an inspection showed no evidence of fire. The lower forward fire loop chafed and shorted out on the main fuel feed support bracket.

A KC-135 lost the left hydraulic system quantity because of an improperly clamped bypass hose on nr 2 engine.

Chafing can be controlled, but it requires every maintenance technician and supervisor to be aware of the potential for chafing. Technical orders provide only partial guidance on prevention of chafing. But we can lick the problem by using a combination of tech data, knowledge and extreme care. Come to think of it, those are the qualities exhibited by our best performers in all jobs. ★

OOPS!

THERE WENT ANOTHER OVER-"G" LOAD

ROBERT B. SHANKS
Directorate of Aerospace Safety

It was the summer of 1959 when a lone pilot in a delta wing aircraft took off toward an approaching rainstorm. He wasn't hit by lightning, but 80 seconds later he was just as dead as if he had been.

Transient maintenance, through misunderstanding, had delayed his turnaround and he was probably irritated by the delay. He took off in A/B and was still in A/B when both wings came off in an upward manner. Something some people said couldn't happen to a delta wing aircraft.

Fourteen years later a flight of two delta wing aircraft took off in the direction of another rainstorm. Lightning struck both aircraft after they had entered the clouds. Lead was struck on the pitot boom, while the wingman was hit back of the cockpit. Lead broke out of the overcast and lost his wings trying to avoid collision with the ground. The wingman broke from lead, climbed out on top and recovered safely. At first the accident board refused to accept the fact that a delta wing aircraft could lose its wings in a pull-up.

In the first accident the feel bellows diaphragm was damaged, probably by oil or solvents deteriorating the rubber surface coating, so that air was free to pass through the diaphragm and little or no artificial feel force was generated.

In the second accident, it must have been a last ditch, desperate

FIGURES A THRU D: EXAMPLES OF SEVERE SKIN STRESS

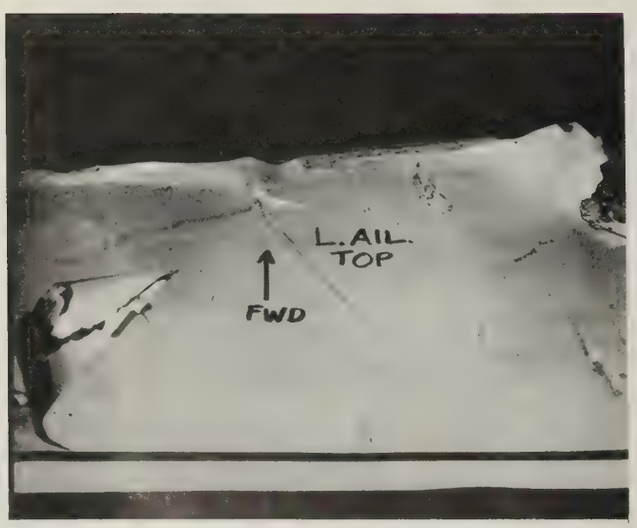


FIG. A

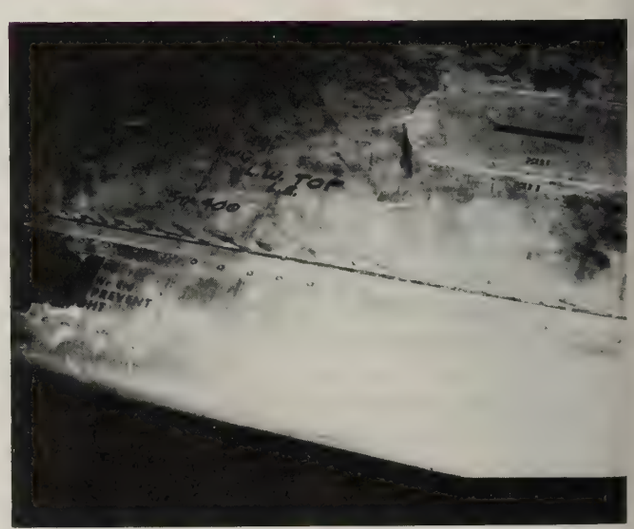


FIG. B

FIG. C



FIG. D



effort to survive that moved the stick back faster than the aircraft structure could tolerate. A piece of the right elevon separated before the wing failed.

When jet aircraft first became a practical reality, the need for hydraulic flight controls and some method of keeping the pilot from moving the controls too far and too fast for the strength of the aircraft structure, was recognized early in the design phase. There were different control designs developed, all with a common purpose of trying to make hydraulic controls feel like the old direct linkage controls, where the pilot could feel the load he was placing on the control surfaces. The purpose of course was to keep from pulling more "G" than the aircraft could safely take. Now it looks like we're going into fly-by-wire designs with just a little wrist motion, so you can still control the aircraft while pulling G that would have destroyed earlier model aircraft.

During the last five years, there have been 41 documented instances of aircraft pulling excessive G. In thinking about this subject, one wonders how many times an aircraft is overstressed and not reported. Probably not too often, since our aircraft have accelerometers with needles that indicate the maximum positive and negative G experienced during flight. However, repeated overstressing of aircraft could lead to a fatigue type failure. This is why it is so important to perform an inspection whenever the allowable G limits are exceeded.

A recent accident occurred when an undetected crack developed in the wing fold locking lug of a fighter aircraft. No one knows when the crack occurred. Once a crack is initiated, then even allowable Gs can cause it to propagate to failure. Unfortunately in this case, the wing tip did not make a clean separation. It struck the aircraft and damaged the controls, and the loss of control

WING FOLD LOCKING LUG



made the accident inevitable. Small cracks in their initial stages of formation are difficult to see and detect. It takes an experienced hand who knows where to look. Each aircraft has its own weaknesses and strengths.

Detailed information on G limits and inspections begins with Section V of the pilot's handbook. More data are provided under special inspection, Section II of the dash Six technical order. There are two levels of inspection depending on the degree of overstress applied. If the dash One limits are exceeded and the dash Six limits are not exceeded then a minor inspection is required. However, if both the dash One and the dash Six limits are exceeded, then a major or depot inspection is required.

From the pilot's point of view, there are some lessons to be learned from analysis of the 41 instances of overstress. The first and obvious fact is that most overstress instances occur in fighter and trainer type aircraft. The T-38 and F-4 alone accounted for 32 of the 41 instances in the last five years. Logical deduction based on accident analysis indicates that a prior overstress can start a crack which subsequently

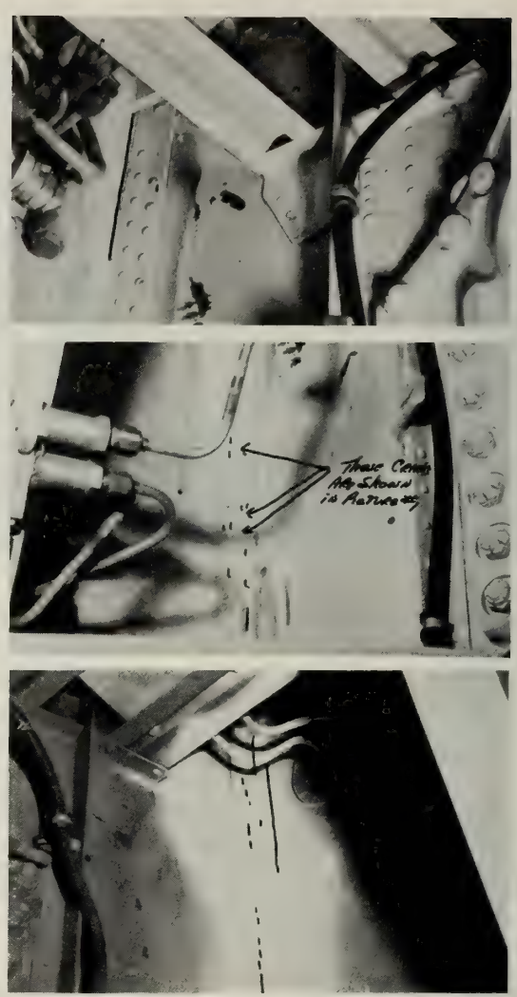
fails during an otherwise normal maneuver, and an innocent pilot gets charged with an accident.

Another observation is that pilot emotions and reflex actions are the chief cause of aircraft structure overstress. The pilot often becomes intent on a particular task and then suddenly realizes he is out of position and impulsively moves to correct the situation, with the result that overstress occurs. We may not be able to avoid this natural action, but we certainly can be sure that the overstress condition is reported and that an inspection is made before the next flight. Probably one of the things a pilot should do is get into the habit of looking at the aircraft after a mission to see if there are any detectable wrinkles in the skin of the wings and fuselage. Sometimes these are not too noticeable unless you get the light shining on the surface at the right angle.

Another source of overstress has been cutting across an aircraft's trailing vortexes. Readings of plus 10 and minus 2.5 G were indicated on an F-4C that cut through the leader's so called jet wash.

Some aircraft have a tendency to nose down in the transonic range—known as a mach tuck. In one case where the initial loading was 5 G when the aircraft entered the transonic region, a resultant loading of 8.2 G was recorded after experiencing the mach tuck phenomenon.

Strange as it may seem, clouds also contribute to overstress. In several cases, an abrupt maneuver to avoid entering clouds has resulted in overstress of the aircraft. Also clouds are sometimes in the vicinity of severe turbulence. For the extreme case, there is the turbulent, clear area under the hammerhead of a storm cloud. We lost a B-58 that tried to penetrate this clear air area at high speed. One of the T-38 incidents occurred when a student attempted to remain clear of clouds. He encountered extreme turbulence and was "batted around the cockpit." During recovery from an improperly performed high speed dive, an over-G condition occurred.



The above pictures show three views of wing fitting cracks which resulted from excessive G.

Last but not least is the potential hazard always present while performing aerobatics. Induced oscillation and momentary disorientation while flying near moving but widely scattered cloud buildups have resulted in nose low, high speed dives from which too rapid recovery was initiated causing an overstress to the aircraft.

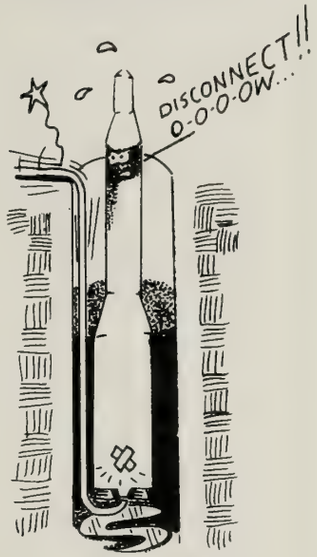
An overstress also occurred when evasive action was taken to avoid a mid-air collision.

Most of the overstress conditions could be avoided if one could control automatic reflex actions. The only recognized way known to do this is to plan ahead and anticipate the situations that can occur and then control the natural reflex action. Perhaps this is easier said than done. It's like slamming on the brakes of a car when a blowout occurs. The natural impulse has to be resisted or you're in trouble. Excesive G loads may not harm you, but failure to report them may kill somebody else. ★

MISSILE TOPICS

ADDING INSULT TO INJURY

Recently, the missile force experienced back-to-back incidents on one Minuteman missile. The first mishap involved a sodium chromate leak with resulting "wet missile" damage. Adding insult to injury, the missile was then removed from the launcher with the lower umbilical still connected. Result, the further loss of valuable resources. The details are lengthy, so let it suffice that our old bug-a-boo, the human blunder, was much in evidence. What's the moral? Certainly, one would be that we must come to grips with the greatest source of missile resource losses, the human factor.



SHUFFLE TIME

Reorganization time is here. Effective 1 July 1975, a new division, the Weapons Safety Division was implemented. The chief of this division is Col Vito Longo and there are two subordinate branches: the Explosives Safety Branch and the ICBM, Drone, and Space Branch. Other than the incorporation of the Dones, there is little difference between the functional mission of the former Ground Launched Missile Branch and the new ICBM, Drone, and Space Branch. This reorganization streamlined staff work and allowed for more effective management.

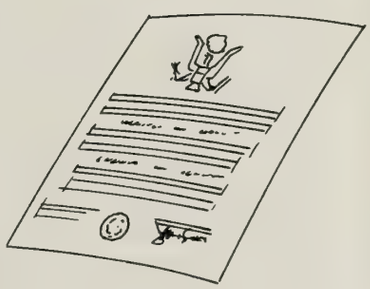
Along with this reorganization, a 100 percent turnover of ICBM safety personnel was experienced. The new personnel are: Lt Col Jay Close, Maj Bob Boese, and Maj Tom Vitito. They are experienced ICBM maintenance personnel who stand ready to assist you, either through their extensive project visit program, written communications, or telephone calls.

The Autovon number for the ICBM, Drone, and Space Branch is 876-5058 and the office symbol is still AFISC/SEM.



LT COL LANGILLE RETIRES

After 27 years of active duty, including 14 years working with ICBMs, Lt Col Frederick A. Langille retired on 31 July 1975. During his more than 4 years with the Directorate of Aerospace Safety, Col Langille made significant and lasting contributions to the Air Force missile accident prevention program. We know that his many friends throughout the missile force join us in expressing our gratitude and wishing him health and happiness in his retired life.



LEST WE FORGET

Ten years ago a contract worker severed a pressurized hydraulic hose with an electric arc while welding in a Titan II missile complex. This missile accident —the most costly in terms of human life—resulted in the deaths of 53 people.

Five years ago at a Minuteman launch facility, the bolts were sheared on a tee box cover and the cover dropped into the launch tube striking the missile. Cause was failure of a maintenance team to use proper procedures when closing the launcher closure.

One year ago a job controller erroneously directed a maintenance team to completely shutdown a Minuteman launch facility when only partial shutdown was required. He then compounded the error by directing the team (which was not qualified to perform start-up procedures) to start-up the site by performing the shutdown procedure in reverse. As a result, a cable assembly was damaged beyond repair. ★

tech topics

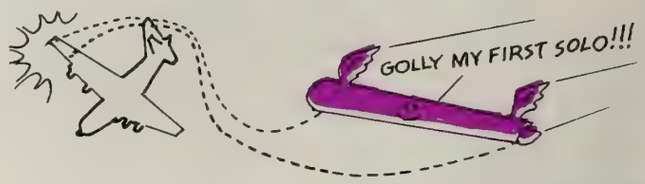
pod problem (again)

Out of adversity sometimes comes progress. Here's an incident which could have turned into something much more serious and from which F-4 users can learn. When the F-4D was prepared for deployment, the ground crew improperly installed the baggage pod. The forward pod hook was secured to the aft lug on the inboard pylon, which placed the pod several feet aft of where it should have been. During gear retraction and extension the wheel well door caught on the pod and was bent out of shape. This caused a jagged piece of metal to rub the tire and shave off considerable rubber during the landing roll. This is an old problem that has been reported in this magazine several times. As a result of this incident, the unit now paints a red stripe on the pods to match with the MAU-12 (front lug). Beside the stripe will be painted "14 in lug." Also the letters FWD will be painted on the forward section of the pod.

B-nuts, a pair

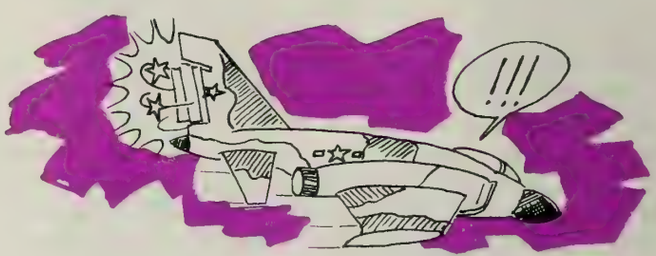
B-nuts are fine connectors but they will bite if not treated right. A couple of them were improperly torqued but their condition was found on the ground prior to the B-52H taking off. The crew was alerted when the nr 1 main and aux rudder/elevator lights illuminated. The aircraft was stopped, maintenance called and two hours were spent finding the trouble, securing the nuts and servicing the depleted hydraulic fluid. A nearly identical situation occurred on a B-52H from another base, only this time in flight. That one cost $3350 to repair.

lost wing section



During the acceptance check flight of an AC-130A, 22 feet of the outboard section of the left wing leading edge departed the aircraft. Inspection found that the lower hinge pin was not engaged in the hinge half of the forward wing spar. With 22 feet of the leading edge missing the pilot experienced some control problems but he made a successful landing.

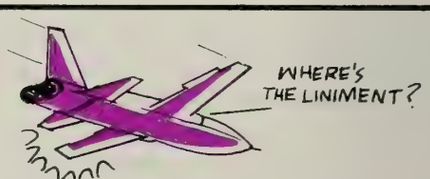
nervous rudder



Right after takeoff an F-4E had several rudder inputs. A wingman checked the rudder and found it was oscillating from side to side. The pitch aug was turned off and oscillation ceased; however, during the remainder of the flight the rudder pedals would kick violently every two to three minutes. Fuel was burned down and the pilot made a successful landing.

Troubleshooting found that the cannon plug on the rudder power control cylinder was improperly installed. The female portion of the cannon plug was secured to the bulkhead with bolts having heads larger than the proper bolts. When the male part of the cannon plug was connected and turned to lock, it would contact the bolt heads which would not allow it to lock into place. The cannon plug then vibrated loose, causing the rudder inputs.

stiff aileron



During an FCF for a dual rudder actuator change on a T-38, the pilot noted the left aileron control to be very stiff. The right aileron was OK. He applied the left again and it bound. After a few minutes he managed to free the left control and made a successful straight-in approach and landing. Maintenance found two loose screws, one lodged between the left aileron control cable and the pulley on the aileron support bracket.

strange FOD



During a crew chief's dash 6 preflight inspection of a B-52D he found the oil cooler flaps open on one engine. A more detailed inspection revealed FOD to the engine. Prior maintenance had been performed on the ground oil cooler flaps, then the engine was removed for other maintenance. When the engine was reinstalled an operational check was complied with. During operational check the ground oil cooler flaps opened and possibly a metal object was ingested. The metal object was never identified but it was worth $46,000.

flight controls pinned

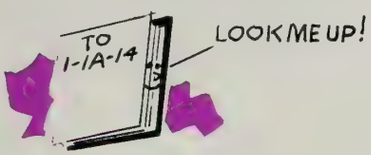


While performing the before takeoff checklist on a C-141 the pilot was checking flight controls, and the yoke would not move forward past the neutral position. Inspection of the flight controls revealed a rigging pin partially installed in the elevator pack cylinder. The aircraft had flown several sorties since last maintenance on the flight controls.

expensive concrete

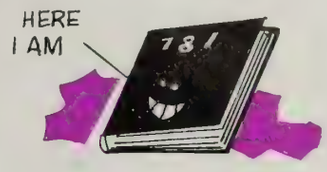
Inspection of the inlet on a C-141 aircraft engine after ground runup check revealed that several first and second stage fan blades were nicked and torn. Cause of the damage was deteriorated concrete on the parking spot which was sucked into the engine during operational check for compressor stall. The damage required an engine change. A lot of ramps can be sealed for the price of a damaged engine.

wire woes



The crew of a C-135 was on a routine training mission and everything was normal. The landing gear was lowered and all three were checked down and locked. A planned missed approach was performed and the landing gear retracted; however, the nose gear indicator showed intermediate. The gear was lowered but the nose gear still showed the same indication. The landing gear was recycled and the nose gear lock alignment stripes visually inspected and they were properly aligned. After an uneventful landing investigation revealed that during aircrew preflight the aircrew detected the wires from the nose gear down switch were unbound. The aircraft commander brought it to the crew chief's attention and he tied the loose wires together with safety wire. When the gear was retracted on the missed approach the safety wire snagged and caused the nose gear position indicator wire to break. TO 1-1A-14 gives the correct methods for securing bundles of electrical wiring.

where was the 781?



As the technician advanced the throttle to start nr 1 engine on an F-4, the EGT began to increase rapidly and exceeded the 750 degrees limit. The cockpit man was advised there was smoke coming from the engine. The engine was shut down and the fire extinguisher used to spray into the aft section of the engine. The engine was removed and sent to depot for inspection. The causes for this fiasco were many. Numerous Red X's were open concerning the engine installation, and the crew chief attempted to start the engine without looking at the 781. No one removed the intake cover nor was the pre-intake inspection completed. It is evident that some maintenance personnel are not completely familiar with TO 00-20-5. This tech order with the ominous title of "Aircraft, Drone and Air-launched Missile Inspection, Flight Reports, and Supporting Maintenance Documents" covers the 781. The 781 will never replace PLAYBOY but it can save lives and property and reduce the expenditure of many valuable man-hours. That should be incentive enough to read the 781 before performing work on an aircraft and its systems. The basic red symbols are used to record warnings in the aircraft 781 forms. A sharp eye in catching an item entered on a Red X that has not had the proper supervisory inspection, could mean the difference between doing the job correctly the first time, or redoing at the cost of additional work. Keep "Red X is for danger" in mind. ★

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Mail Call

MAINTENANCE IN HIGH PLACES

1. I enjoy your magazine very much but felt I had to write about your article on "Maintenance in High Places", appearing in the March edition.

2. Mr. Gilchriest's article was very good and extremely accurate; however, I think you did it a disservice by publishing the series of pictures across the top. At first view, many would imagine them to be of maintenance around a C-5, the subject of the article, but in fact, they are of a C-141. Although this may be insignificant at first, two very serious safety problems may have been created.

3. In the photos on page 25, the SSgt is shown wearing a safety harness and attaching the safety strap to a rope hooked between two points on the top of the "T" tail. If this were a C-5, there would have to be a safety pack attached between the safety strap and harness. Failure to use this pack may, in the event of a fall, allow the man's weight to pull the safety harness attach fitting from the tail, wing or fuselage. Additionally, attaching a rope or cable between these fittings would cause extremely high loads in these fittings should a man fall, which may again cause the fittings to fail.

4. The C-5 harness attach fittings were specifically designed to allow up to 2 harnesses with safety packs to be attached to each, but no more. As long as these limits are observed, they allow a man to work in these hazardous areas without fear. To violate this poses significant hazards.

JOHN F. URBAN, Maj, USAF
Operations Systems Safety Officer
Air Force Test and Evaluation Center
Kirtland AFB NM

The photos were not intended to be specific to any aircraft, although they were of a C-141. Thanks for your valuable comments.—Ed. ★

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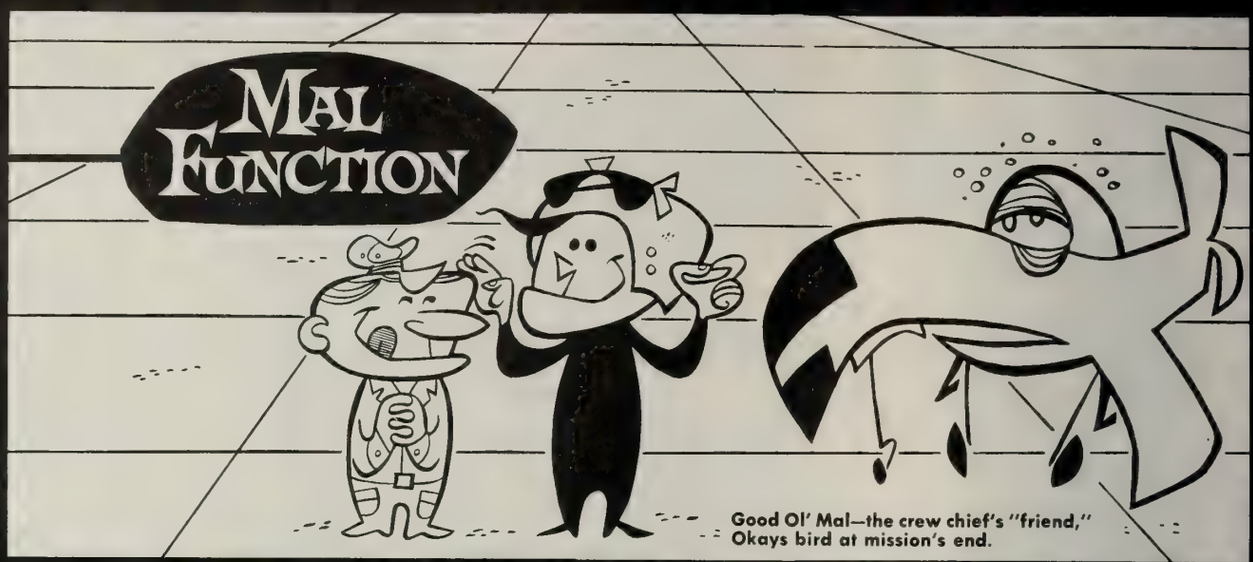


Major
ROBERT M. HOWARD, JR.
4750th Test Squadron
Tyndall AFB, Florida

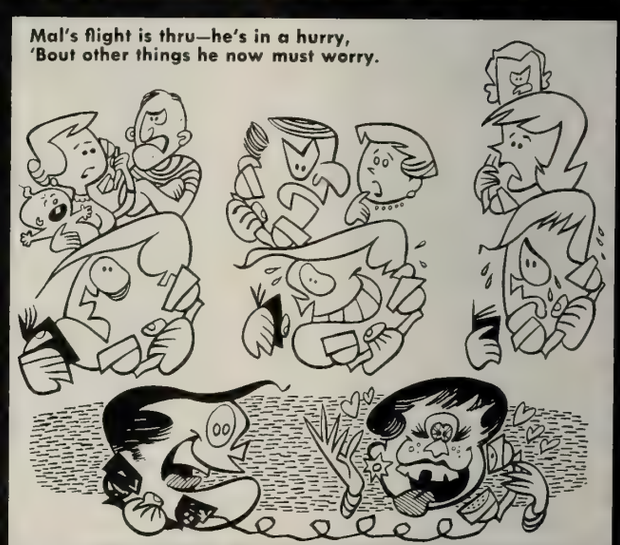
On 18 March 1974, returning from a routine test mission southeast of Tyndall AFB, Florida, Major Howard, flying on another F-106's wing, descended to and leveled at 3000 feet. But when he advanced power to maintain position, the engine didn't respond and the rpm held steady at 79 percent. Reacting immediately he advised Lead of his problem, selected emergency fuel and depressed the ignition button. The rpm did not change. He then tried ignition at different throttle positions—still nothing. With his airspeed decaying, Major Howard lowered the nose to pick up a glide speed of 250 knots. When he saw 2000 feet on his altimeter, he decided to give the bird another 500 feet of additional airstart attempts, then zoom and eject. Nearing 1500 feet, his decision point, and exhausting all the recommended procedures, he decided to try one more thing, the afterburner. He pushed the throttle into the min burner range and felt it light. The rpm, however, did not increase; in fact, it decreased to 76 percent. He did get added thrust, however, and now could maintain level flight. He declared an emergency and headed for Tyndall, 35 miles away. Even with the afterburner, all he could gain was an additional 500 feet of altitude. As Major Howard approached the field, he set himself up on a high final and lowered the landing gear. He stayed in afterburner until he was about a quarter mile from the runway, then brought the throttle back to idle. He crossed the overrun at 240 knots and held the aircraft off the runway until it reached 200 knots, then touched down at the 6000 foot marker, deployed the drag chute and, as a precaution, dropped the tailhook. He stopped safely a thousand feet before the barrier. A faulty engine-driven fuel pump was the cause of the problem. Major Howard's excellent airmanship prevented the loss of an important USAF asset. WELL DONE! ★

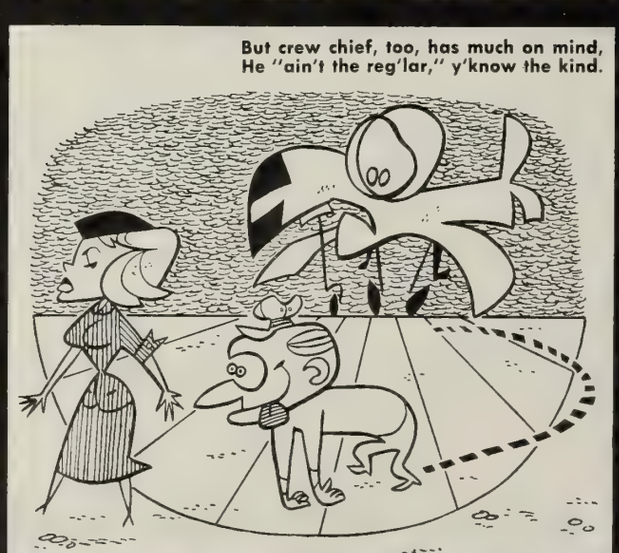
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There Are No New Causes For Accidents











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SEPTEMBER 1975 AFRP 127-2 VOLUME 31 NUMBER 9

Hy the USAF Instrument Flight Cente
Randolph AFB, Texas 78148

THE IFC APPROACH

We all know about see and avoid. Flying safety posters and meetings stress the need for swivel necks and eyes out of the cockpit. In spite of that, here's a situation that can still jump up and bite us in the fuselage.

You are making an ILS approach to runway 35 at the home airfield. You, of course, have an IFR clearance, even though the weather is well above VFR minimums. You are about three miles from touchdown when suddenly you're on a collision course with a light aircraft. He is coming at you from the right and sees you about the same time that you take evasive action and miss him. He lands at a small airstrip five miles southwest of the base. You report the near miss and find out that the tower had neither knowledge of nor communication with the light aircraft. What's happening here?

Take a look at any sectional aeronautical chart and notice the number of civil aerodromes near major airfields frequented by Air Force pilots. As an example, let's look at Richards-Gebaur. Four civil and public use airfields are located within the R-G airport traffic area.

Now let's consider a few questions:

Q: May an aircraft operate in an airport traffic area without establishing radio contact with the tower?

A: Yes. In the example, the light aircraft was operating there for the purpose of landing at an airport within the airport traffic area. (Ref: FAR 91.85[b]). The light aircraft was not required to establish radio contact with the tower because he was not operating to, from, or on the airport with a control tower (Ref: FAR 91.87[b]).

Q: In the situation above, did the aircraft on an IFR clearance or the light aircraft have the right-of-way?

A: The light aircraft had the right-of-way. Since both aircraft were in VFR conditions, the see-and-avoid concept applies. When aircraft of the same general category are converging at approximately the same altitude, the aircraft to the right has the right-of-way (Ref: 60-16, paragraph 5-4 and FAR 91.67[c]).

Q: So what are we trying to do, scare everyone?

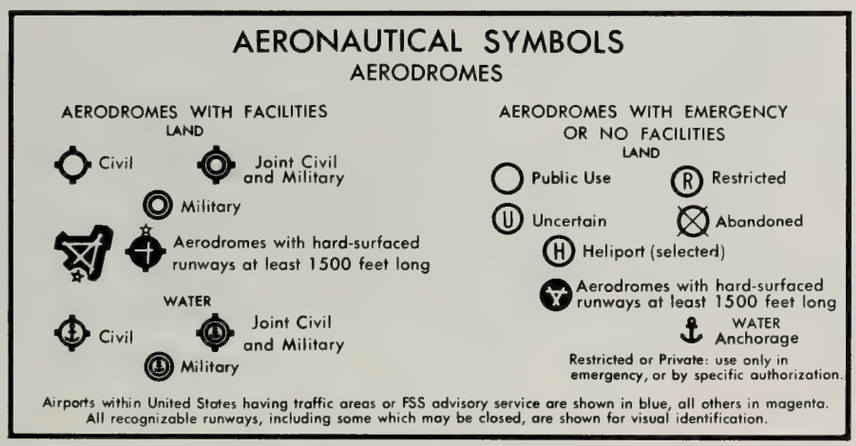
A: No, just trying to make pilots aware of a possible hazard.

Some uncontrolled airports are noted in the aerodrome remarks section of the IFR Supplement. If you find one at your destination, don't be complacent and think you're golden because you are flying on an IFR clearance.

SEE AND AVOID

Have you looked at a sectional chart to locate the small airports near the airfields that you use for training missions? Think I will.

Feedback needed. What do you want to see in these articles? Drop us a card (address is above) or call AUTOVON 487-4276. ★







TORNADO ON THE RUNWAY

L. W. "BILL" DORESEY, Base Disaster Preparedness Officer, Altus AFB, Oklahoma

The time: 0035 local. A winter storm has been predicted for Southwest Oklahoma. Light snow, freezing precipitation, possible moderate rain. At DET-4, 15th Weather Squadron, the duty forecaster studies the approaching cell on radar. It is just beginning to approach severe limits, then suddenly, the set malfunctions. How else would you explain the sudden appearance of a hail shaft or echo-free vault on the radar only 20 miles South of Altus and Altus AFB in a moderate winter storm?

0037: A call from Bob Mayotte, Altus Civil Defense Director; one of his watchers has reported a strange, ominous cloud and strong winds to the south. You tell him about the strange actions of the radar, but reassure him nothing severe is forecast. You'll keep watching.

0040: A call from Bill Doresey, Base Disaster Preparedness Officer. He has heard reports on his police scanner which indicate that the sheriff and local police are watching a severe cell approaching from the south. You reassure him —no severe weather is forecast and, although the radar is acting strangely, no sweat. Bill tells you that a sheriff's deputy is just now reporting a barn blown down near the Olustee "Y," 5 miles West of Altus (he is hearing it on his scanner). You go back to your radar—maybe it isn't acting up. Maybe it is trying to tell you something. No, no hail shaft could be that large—**not two miles wide;** it couldn't be a tornado—not in a winter storm. It has to be a radar malfunction. Check with your backup at Sheppard AFB, Texas.

0045: Winds are picking up. Sheppard's radar is down. Try Oklahoma City—can't get through. The radar is still acting up. Watch the sky.

0049: Hail is reported south of Altus. Winds are over 50 knots.



TRAILER PARK ON BASE, ALTUS AFB
OKLAHOMA, 22 FEB 1975

Maybe it's true. Advise Altus Operations Center to sound sirens.

0050: We lost our electricity. Lights are out all over the base and City of Altus—geez, that wind was strong. The forecaster in the weather tower reports he saw a TORNADO right down the runway.

A TORNADO??? In February?

Yes, this actually happened at Altus Air Force Base in Southwestern Oklahoma. A surprise tornado on February 22, 1975. The peacetime alert signal was never sounded because all electricity for Altus AFB and the City of Altus (population 25,000) was lost at the very time they tried to blow the sirens. Damage reports began filtering in almost immediately to the City Police Department, Altus AFB Operations Center, the County Sheriff's Office, Base Security Police, and the Civil Defense Emergency Operations Center. Maintenance teams

continued



MOBILE HOME DAMAGED—LA VILLITA TRAILER PARK
22 FEB 75

began surveying the flight line, security police and sheriff units started checking the city. Base Disaster Preparedness and City Civil Defense units were activated automatically, all according to plan.

By 0110 the first damage assessment had begun and reports were filtering in. Prime Beef Team electricians are checking the lines, Job Control reports all aircraft have been moved from their parking spots by the force of the wind. **Even the C-5's!** Security Police report storage sheds blown over, trees and power lines down, camping trailers and boats have been damaged in their base parking area.

0130: The City is requesting portable generators for the Sheriff's Office, radio system, and for radio station KWHW.

0140: The hospital reports emergency generators not functioning properly; need portable lighting units; casualties are arriving. 4th Mobile Communications Group assigned task of providing generators and portable lighting units to hospital and civil agencies. City reports major damage at La Villita Trailer Park and requests generators and portable lighting units to assist rescue efforts. 4th MOB tasked to provide units.

0210: Military personnel and dependents whose mobile homes have been destroyed or severely damaged are arriving at the main gate seeking refuge. Most are being taken in by friends in the Capehart Housing area. Others will be provided quarters by the Base Billeting Office.

0310: More hospital reports, both from the base hospital and Jackson County Memorial. No injuries or fatalities from on base. The injured came from La Villita Trailer Park or other mobile home parks. Their homes had just exploded or been lifted from the foundations.

0315: Received request from Civil Defenses for cots and blankets for the people at La Villita. The Red Cross has prepared space for them in the clubhouse there. 4th MCG again tasked.

0330: Volunteer Civil Defense and REACT teams are responding to assist in damage assessment and search and rescue efforts.

Our plan seems to be working. All damage reports are being relayed to Disaster Preparedness Officer and representatives in the Operations Center. Requests from civil authorities are being coordinated by the Disaster Pre-



LA VILLITA TRAILER PARK
22 FEB 75



SEARCH TEAMS, LA VILLITA
TRAILER PARK 22 FEB 75

paredness Officer. Everyone seems to know what to do. How lucky that we just had our annual base/community natural disaster exercise on 17 December 1974. Many of us thought a tornado exercise would be a waste of time when it was originally proposed by the State Civil Preparedness Agency and our local Civil Defense Director. But lessons learned? I guess!!

How long would it take to restore electrical power to the City or Base? Who do we call?? How about re-routing power lines for the hospitals, nursing homes, etc? What kind of assistance will the City need from the Air Force? What can the City do for Altus AFB and for our military personnel and dependents who reside in the surrounding community? What is the best way to route damage assessment teams? What communications do we have when we lose electrical power and telephones are swamped with calls? Non-Tac, MARS, Citizens Band? What frequencies? Local Red Cross, Salvation Army, Prime Beef, DPST, REACT, Civil Defense Teams, Explorer Scouts? How can they help? Who reports damage to whom? Who reacts? When?

These were many of the questions answered during the exercise. Both Altus AFB and the city learned. Tonight we reap the benefits of our tests and advance planning.

Yes, two military dependents lost their lives to this storm and 43 more military and civilians were injured off-base. C-5 and C-141 aircraft were turned in their parking spaces on the flight line, roofs and buildings were damaged on base and 136 mobile homes were destroyed or damaged off base. But what about what didn't happen?

No aircraft maintenance stands were blown across the ramp or into aircraft. No AGE was reported loose or flying around the flight line area. No damage was reported caused by loose or flying objects in the Capehart Housing Area.

WHY? Because this Southwest Oklahoma community has learned to respect the unpredictable high winds which always threaten. We secure or lock up everything that might blow (except airplanes, automobiles, or buildings). Our maintenance personnel and security police constantly patrol and look for items that might break away or cause damage. You might say we are "TORNADO HAPPY." We strive to protect ourselves and our equipment. We like to think it paid off on Saturday morning, February 22, 1975. ★

WATCH THAT FLAP, JACK



CAPTAIN MILTON G. SCHELLHASE
349 Military Airlift Wing
Travis AFB, CA

It was a hot California evening. I had come home from work and had mowed the lawn and was suffering from what I thought must be terminal hay fever. The phone rang and it was maintenance control inviting me back to help pick up the pieces of a bad boo-boo.

I was thinking "why me" when three answers became glaringly apparent. The first was that it was my troop that had screwed up. The second was that we had a new tiger of a lieutenant colonel and I wanted to have all the answers before he started with the questions. And third . . . oh yes, joy of joys, the wing safety team was coming the next morning for a look at our "safety" attitudes, records, etc.

As I pulled into the parking lot I was thinking how one blunder could overshadow all the good that had been done in the weeks before. And I had an afterthought that maybe this was a reminder about a problem that had been overlooked.

By now you're wondering as I did about what in the hell went wrong. Well come along, you can go out to the WC-135 and take a look with me. As I hopped in the familiar blue bread-truck the expediter said, "It doesn't look good, captain."

"Thanks for the encouragement," I replied.

"Has the colonel heard about this yet?"

"Nope," I answered, "Thought I'd like to know what happened first. I thought as long as he is new to maintenance and has sort of a hot temper, I'd try to give him the full story and soften the blow."

"Good luck," as he pulled to a stop in front of the plane. The line chief was standing by the plane. Even in the twilight you could see that it didn't look good. For starters, the B-4 maintenance stand had two rails that were supposed to be straight but looked like two Vs. But that was cheap compared to what had happened to the aircraft's left flap that had caved them in. I just don't think Boeing made that honeycomb/sheetmetal flap to stand up to the pressure of B-4 stands. The flap had been gouged in two places and it was a cinch that we weren't going to fix it in our sheetmetal shop.

I said, "Well?"

The sheetmetal shop chief said, "No way. . . ."

The ground safety man was jotting busily on his clip board.

The line chief said, "Let's you and I, and SSgt Anderson go on

in and you can hear it all . . . as much as you can explain, anyway.

So in we went, drew a cup of coffee and sat down. The line chief said, "Anderson, you want to run through it again?

Anderson was obviously shaken but he said quietly, "Yes, sir." So he started, "Ski and I were out pulling the preflight for tomorrow's flight. We'd had the B-4 stand out earlier to fix a loose dzus fastener on the nacelle. Later I went up to run the cockpit check. Ski wasn't finished with his part, so when I finished I thought I'd run the flaps through before he got on headsets for the flight control check." He looked at me and paused, "I know, everybody knows, don't move a flight control without someone on headsets on the ground."

I said, "that could have been Ski . . ." but stopped to let him continue.

"I really thought that we'd moved the stand back to the wing tip—really." Anderson leaned back, shook his head, lit a cigarette and continued. "Then I heard Ski yell as he ran up the crew entry ladder. 'WATCH THE FLAPS, JACK!' It was too late."

"Where were the headsets?" I queried.

Anderson looked down and said, "One on the copilot's seat and the other on the engineer's seat."

"Anything else?" I asked.

"Yes sir, Ski didn't have a thing to do with it. I've got nobody to blame but myself."

"Okay, Sgt Anderson, I'll talk to you more tomorrow. Come on, chief, let's go up to Maintenance control. I owe the colonel a call."

"Right, but let's see if safety is through and maybe we can get ready to pull the flap and get the depot shop across base to gear up to fix it so we could have a mission bird one of these days."

I asked, already knowing the reply, "I don't suppose there is one in supply."

"They checked every base in a thousand miles. It would be easier to find hundred dollar bills on the corner."

"Rog—just thought I'd ask."

So I called the old man and laid the whole bad scene on him. He stayed cool which surprised me, but then he was new and we didn't know him very well.

The depot shops opened up for us and, for some expensive overtime, our flap was repaired . . . not to mention some down time on our bird.

Oh yes, the next day I briefed everyone, followed by safety's briefing, etc. "Don't move a flight control unless . . . and get those checklists and headsets out and use them!!!!!" And on roll call we hit that, until every shift could say it backwards and forwards.



I was lying in bed that night thinking about what had happened when I flashed on a tidbit of trivia from a psychology class. The text book said, "Between 5% and 10% of children have an eidetic imagery." That means a photographic memory. But the book went on to say that almost everyone loses it because it interferes with learning. Like trying to read with one page on top of the other. So I wondered . . . what made those people think they could remember just where that stand was? WAS, not to mention where it IS and where those hands and arms are . . . moan. And I defy anyone to recite a checklist just the way it is without missing a step. . . .

So I rolled over and counted flaps until I went to sleep, or until morning, I'm not sure which.

By now some of you have thought . . . yawn . . . "Yeah, I know." Apparently that's what one of our troops thought at roll call, too. Because two weeks later another individual who was blessed with "eidetic imagery" ran another wing flap down onto a B-4 maintenance stand.

The colonel didn't believe it. I didn't believe it. But the man in the depot shop believed it. He said, "Another stand, huh? You guys are just eatin' those flaps up!"

So beware of that ol' photographic memory—'cause first you probably haven't got it. If you have, you have to realize that the best that you can remember is how it WAS—not how or where it IS. And there is that TO change that came in after your flawless memory read the checklist.

But . . . yawn . . . you've probably heard all that before at roll call. ★

MARK HUNTER
USAF SAFETY OFFICER



SNOWPLOWS... IN SEPTEMBER?

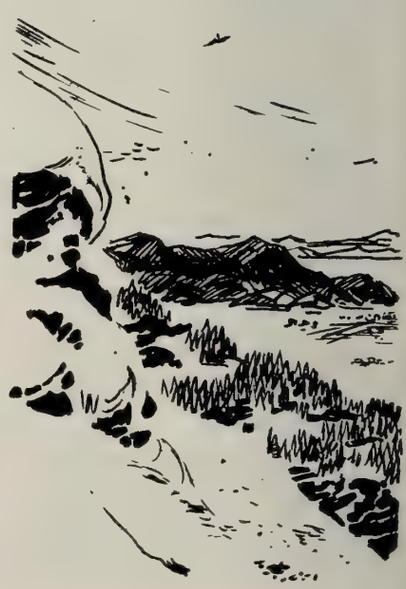
For we who are stationed in the southern half of the United States, winter, even in September, seems very remote. But consider this: within a month or so there will be snow in many of the mountains of the southwest and the temperatures will most assuredly be chilly. If you were to plan a flight from Norton or Nellis to Carswell for example, you might take off and land in 80 degree weather but in between you will over fly some extremely rugged terrain with elevations in excess of 11,000 feet. And, if you go north, much of the United States is already involved in winter by October. Winter flying can be enjoyable. There are some bases close to good skiing areas. But, for the southern based flyer, winter requires some extra effort in planning and preparation.

Now is the time to check your proficiency. Winter brings low ceilings and marginal weather to much of the country, so a little review of AFM 51-37 while you're sitting by the pool can pay handsome dividends later. At the same time why not refresh your memory on the cold weather procedures in the dash one? If the weather is just too hot to stand, remember the simulator building is air conditioned. You can cool off and sharpen up your cross-check so that next 200-½ approach won't be quite so hairy.

When you are ready to go cross country in the winter there are a few extra steps which can save you a lot of trouble. When you check in with the weather forecaster, ask him about weather along the route as well as at destination. As I mentioned earlier, it can be summer in Texas and California and winter in the New Mexico mountains. If you are going north, check on the runway condition. The weather may be fine, but, if water on the runway freezes, you may have a wild ride on landing.

A call to base ops can often fill in information on plowing or deicing operations or other nice-to-know facts. While you're talking to base ops find out about snow on the overrun or along the runway. The lack of contrast between runway and snow covered terrain can lead to serious perception difficulties. You are much less likely to land short if you are aware of the problem.

Once you know what the weather







Pic A, a thorough weather briefing is essential on winter cross countries. Pic B, taxiing on snow-covered taxiways requires more reaction time and good planning.

will be, make sure you have the proper clothing. Clothing requirements should be based on the worst possible situation along the route, not just at destination. It isn't necessary to eject to get into trouble. Imagine having to land at Denver when you are dressed for San Antonio. When you are checking your clothing, check your survival equipment. Make sure the equipment you have is adequate and in proper working order. Also be sure you know how to use it!

If you fly to a base in the cold country, don't let the temperature compromise your performance. Take time to fill out the 781 COMPLETELY AND ACCURATELY. Go into the Transient Alert office if it's too cold to stay outside. When you get ready to go, do a complete and thorough preflight. Look out especially for ice or snow on control surfaces and other special items mentioned in the dash 1. Finally, taxi SLOWLY, more than one cross country has been spoiled by an accident on an icy taxiway.

Winter may still be a long way off in September, but preparation now will mean that we are really ready for that flight to Loring in November. ★



MAJOR CHARLES BARR
Directorate of Aerospace Safety



HEY BLUE FOUR, I NEED HELP

I don't know who first said it, perhaps we would have to go all the way back to Francois Pilatre de Rozier to get to the source of origin. But there is a certain ring of truth to the age-old saying that flying is *hours and hours of boredom intermingled with moments of stark terror.*

Fortunately, our training and our aircraft systems give us, in most serious in-flight emergencies, the tools with which to cope and, more often than not, we are able to return our air vehicles to their intended point of landing with no more than another good bar story to be told. There is, of course, one very insidious malfunction that, given the right time and circumstance, could cause that moment of terror and might rather abruptly terminate your existence—said failure being that unrecognized attitude indicator/attitude director indicator failure.

Historically, Air Force aircraft average one hundred ADI failures per year. Fortunately, most failures are successfully dealt with in flight and therefore only remain incidents. However, over the last six and one-half years we have had eleven accidents in which ADI failure was identified as either causal or contributory.

There is nothing unique about the ADI failure, in that it can and does occur in all types of aircraft. What is unique is the total inability by some of our pilots to handle this emergency in flight. Fortunately the record shows that in the majority of cases this is not true.

There are some good stories

around about people who challenged the system and won. I personally know of a couple that are not reflected anywhere within Air Force records but still remain true. Both stories relate to bomber class aircraft and both by coincidence involve the island of Guam. For the first story we have to go back a few years, to the days when the B-47s were reflexing to this island.

The flight involved a night takeoff for a redeploy mission to the states. Takeoff roll was uneventful through lift-off at which time the instructor pilot recognized he had experienced an attitude indicator failure. In his own words, he knew it was no sweat and that he could handle it. In fact he did for a minute or two, on partial panel. He was actually feeling pretty good for this brief time period, knowing he had everything under control. Suddenly, from the rear cockpit, the copilot asked, in a typical copilot's voice: "Hey boss, what the hell is going on."

The feeling of euphoria was broken, the instructor pilot realized he was in trouble and he informed the copilot that he had lost his attitude indicator and transferred control of the aircraft to him. Circumstances certainly played a significant role in this story. A night takeoff, attitude indicator loss detected at or near lift-off, the ability to detect the failure, adequate schooling in partial panel flying, an observant copilot who was willing to speak when he realized things were going from bad to worse quickly and, finally, the realization, by the instructor, that he was in trouble and needed help.

The other story occurred some years later, during the height of the Vietnam conflict and involves two close personal friends of mine who, I hope, will forgive my relating this story here. The mission was a bomber deployment from the ZI to Guam. Shortly after coast out the first ADI failed. In consideration of the forecast weather and daylight flying hours, the pilot, again an instructor, elected to continue the mission. Subsequently, with Hawaii under his wing tip, the second and last ADI failed.

Here's the situation: both ADIs inoperative, destination weather forecast good, day visual meteorological conditions enroute and an operative auto pilot. The decision: continue to destination. Judgment —not good, for two reasons: (1) everyone can use a day or two in Hawaii, and (2) the unknown 3000 miles ahead.

Lady Luck was riding with this crew this day and, in fact, the trans-Pacific crossing was routine. However, at Guam—you guessed it—the weather was less than optimum. Much to the surprise of Guam Approach the pilot requested a no-gyro GCA which was immediately rejected with words similar to, "We don't approve practice no-gyro approaches here." And, I am sure Guam was equally surprised at the next response they heard crackling through their earphones: "Hey babes, I don't think you understand. This ain't for practice." Suffice it to say the approach was flown and the aircraft landed safely.

Can we challenge this pilot's judgment? Sure—I have and he has himself. What we can't challenge is his ability and his deeply founded understanding of partial panel instrument flying techniques, techniques gained through many hours of partial panel flying and simulation. Those techniques that were taught in the old school, of fifteen years ago; that I'm not sure are being taught or practiced today.

There are of course those incidents where ADI failures result in a catastrophic loss of life and equipment. It would be subjective on my part to say that, in all cases, the loss of the ADI was detected in time to change the sequence of events leading to the accident. However, in one case, of which I am personally aware, this did occur. In that case the pilot, following a precessing ADI, flew his aircraft into a bank, pitch attitude from which he was unable to recover. In my opinion more than adequate verbal/visual cues were being provided in that an excessive altitude loss was being announced (1000 feet every four to six seconds) which should have alerted the pilot to some unusual problem. Additionally, a second pilot, who as well as the first pilot, had access to a completely operable ADI and yet they either disregarded or failed to note the differences between the two systems. As a result, the aircraft crashed and four lives were lost. Why? Loss of control, sure; but why loss of control? Perhaps a couple of reasons. One being that the initial ADI failure was insidious in that no "off" flags were visible, and maybe the second was the inability to revert to a basic partial panel technique which probably could have stopped the sequence before it really got started.

There are other indications, in other aircraft, of this same inability to revert to basic partial panel flying techniques when loss of an attitude indicator occurs. In support of this argument let's review the following accidents:

The first concerns a flight of three on a day intercept and instrument training mission. Shortly after takeoff the lead aircraft entered layered clouds on established climb speed. While in the clouds the pilot intuitively felt something was wrong with the aircraft; however, he failed to immediately detect the source of the problem. He did, however, notice a fifty knot decrease in airspeed as he concentrated on maintaining a normal pitch attitude on his ADI. As the airspeed was dropping through 300 kias the inertial navigation unit failure light illuminated and the ADI tumbled. Aircraft control was transferred to the rear seater, a non-pilot, who was unable to recover the aircraft. Both crewmembers ejected successfully.

In another accident the aircraft, shortly after lift-off, entered instrument flight conditions. Again the

Continued

pitch attitude was established at ten degrees nose up as the aircraft accelerated to climb speed. At approximately 250 kias the pilot noted flashing wheel lights and checked the gear indicators to confirm the gear position. While transitioning back to the flight instruments, the pilot indicated the aircraft felt strange; however, the attitude indicator still indicated a ten degree climb. Suddenly the pilot got quite light in his seat and informed his back seater that something wasn't right. Crosschecking his altimeter and vertical velocity, the pilot noted the altitude to be decreasing through 2000 feet at between 500 and 1000 feet per minute. Back pressure was applied to establish a positive climb rate as the aircraft broke through the clouds in a five-to-ten degree nose-low, right wing-low attitude. Back pressure was increased and the nose rotated through the horizon just as the aircraft crossed a stand of trees. After tree impact, the aircraft was successfully flown above the cloud deck. With assistance from another member of the flight, a successful approach and landing was made.

Even more recently, one of our Air National Guard pilots experienced an attitude indicator failure during an annual instrument check. Whether the guy passed or failed the checkride is not important for this writing. But I feel the subsequent action taken by this wing is. Perhaps some small part of the story should be told so everyone has a clear understanding as to why the local experiment was conducted.

The examinee, in the rear cockpit, briefed the flight examiner (FE) prior to takeoff that, after lift-off, he would be lowering the hood and that any departure instructions given were to be followed by the FE until he (the examinee) was ready to assume control of the aircraft. After lift-off, departure control cleared the aircraft for a right turn of fifty degrees, on course.

The rear seat pilot secured the hood and assumed control of the aircraft, wondering why the FE had not initiated the right turn. Without crosschecking any other instrumentation, the rear seat pilot applied control pressures to establish the aircraft in a 30 degree right bank. At this time, he noticed the heading indicator turning while the attitude indicator was indicating a 15 degree nose up, wings level attitude. A partial panel unusual attitude recovery was attempted as he informed the FE of his attitude indicator loss. The FE recovered the aircraft from near 90 degrees of bank and aborted the flight without further incident. After this incident the unit modified their simulator folks so they could duplicate the exact sequence, without, of course, telling the pilots. Within one week, four of nine pilots tested crashed within 10 seconds after the malfunction was introduced. We are not talking about low levels of flying experience in this wing. The lowest man had 988 hours in aircraft type, while the high timer had over 5500 total hours with 2377 in type.

In the majority of the attitude indicator failures presented here some significant points come to light. First, in all cases where the pilot was trapped and needed help, instrument flight conditions existed. Second, the transition to other flight instruments was slow or non-existent. Third, without visual reference to the horizon and/or a slow instrument crosscheck, an unusual attitude was encountered within seconds.

Well then, one might ask, where do we go from here? I wish I had an immediate answer, but I don't. Perhaps one suspect area is our training. In years gone by, we trained utilizing an instrument hood and at least occasionally on a partial panel; i.e., heading indicator, altimeter, airspeed indicator, turn and slip indicator and vertical velocity. Today this seems to be a lost art or, at least, has a minimum level of acceptance; however, the facilities are available for such training through simulation and at least one of our MAJCOMs has recently reinstituted just such training as an integral part of their flight simulation program. With regard to the instrument hood, I didn't like it when I was flying it and I think the decision by most MAJCOMs to do away with it was a valid one. However, in practicing instrument maneuvers without some restrictive devise, one has a tendency to cheat, which I most sincerely discourage. The time to learn to fly good instruments is during VMC conditions. All it really takes is dedicated effort and practice. This also is the time to learn to cope with such emergencies as attitude indicator failure. I still have a one-quarter inch plywood cutout, specifically designed to cover an attitude indicator, which was presented to me years ago by my first aircraft commander. Although I no longer use it, it's still a valid tool for teaching partial panel flying.

If your wing doesn't have a valid simulator instrument training program ask them to develop one. Hell, I've been out of control more than once in a simulator but, fortunately, never once in an airplane.

The ability to handle an attitude indicator failure depends uppermost on your own capabilities—with the key being the capability to recognize the malfunction. Sometimes it's easy in that the red off-flag is visible, sometimes it's not. Flight instruments are presented in a package and more cues are available than just those presented by the attitude indicator. However, those cues are not available without an instrument crosscheck, and, quite honestly, that's your best chance for survival. Work on it, practice every chance you get in both the simulator and in flight and, perhaps, rather than becoming an Air Force statistic, you too will have a good bar story to tell. ★

a blind man's look



So the second blind man said, "No, it feels like a wall," and the third said, "This elephant feels like a rope." Like the five blind men in the story describing the elephant, some of us see aviation safety through different eyes.

As a nonrated type, my views come from the back seat of the aircraft. It's enlightening to see what my presence back there generates. Did the pilot actually see that I was strapped in properly? Did he look to see if this ground-pounder left a strap hanging out of the back door? Did he look to see that the door was closed and latched securely? How about reminding me that the sleeves on my fatigues were rolled up? I have wondered on occasion why the copilot didn't think he needed gloves just because he was in the other seat.

I have watched two young men go through their preflight check of an aircraft, find a questionable area and apparently in the interest of mission completion, pursue it no further. They did not ask me if I was in a hurry, so I wondered why the crew chief was not consulted for his expertise. I have also watched other pilots go through that lengthy checklist, knowing how many times they must have done it before. I anticipated enjoying my ride much more as they meticulously covered each and every item, using the book.

I must admit to a degree of annoyance when a cloud shelf moved underneath us one day while we were in an OH-58. We were about 30 minutes out on a scheduled 2-hour flight, and the pilot did a 180-degree turn and returned to the airport. But I also had to recognize the professional attitude of the pilot concerning the safety of his passengers and aircraft.

I was curious on several occasions as to why pilots and copilots made a big deal about passing the controls to each other. Since my involvement in aviation I now get the AVIATION DIGEST and APPROACH. There was my answer. APPROACH told of a helicopter flying off a ship with each aviator thinking the other had the controls. They realized their error only as the aircraft began to settle slowly into the ocean.

My office is not near a hangar or pilot readyroom. But when I'm at the airport, it's good to hear pilots discussing safety practices in their bull sessions, and to see posters displaying those lifesaving messages. I have even eavesdropped on a master aviator as he counseled two young warrant officers because their 20-minute fuel warning light came on and they made a precautionary landing in a farmer's field. First came praise for their airmanship, and then he questioned their judgment for allowing this fuel shortage situation to occur in the first place. I hope his unkind words made a lasting impression on those two lads.

My turn to counsel came one day in the hangar when I saw a soldier, with a cigarette in his hand, spray painting a sign with an aerosol container.

Well, there it is. I certainly have not described the whole elephant. I'm sure a tower operator can come up with his hair-raising tales, and the crew chiefs and pilots have their experiences. The one sure thing I have found is that this safety business is everyone's business and we all should stick our noses into it.

If one flys them, fuels them, maintains them, rides in them or just stands on the ground enviously as they roar off, safety has to be part of his life. There is no alternative.

Courtesy Colonel Roger J. Kesselring, USAR
United States Army
AVIATION DIGEST

Colonel Kesselring is a graduate of the Infantry Officer Career Course and the School for Inspectors General. He is a former inspector general with Headquarters, Fifth Army, and is now Inspector General, 416th Engineer Command (Construction), Chicago, IL. ★

FEATHERY FACTS FOR



The heaviest birds that fly weigh in excess of 20 pounds and include various species of Cranes, swans and condors

The bird with the longest wingspan is the wandering albatross. Wingspan: 12 feet



Starlings have been known to congregate in a flock of 15-20 million birds.



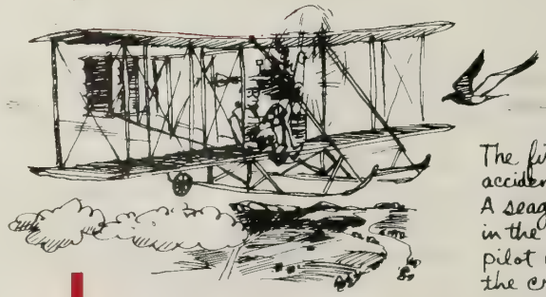
Most small birds migrate at night



The longest migration route for any bird is that of the arctic tern. (12,000 miles... arctic to antarctic)



The impact force of a 2 pou bird at 250 k is over 17 mil foot pounds.



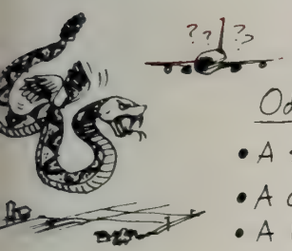
The first birdstrike accident was in 1910. A seagull got caught in the control cable. The pilot was killed in the crash.



½ to 1 billion birds migrate through CONU each year.

YERS

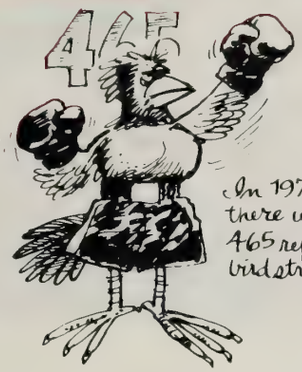
Have you ever wondered what is going through a bird's mind when it finds itself eyeball to eyeball with an object many times larger, thousands of times heavier and traveling, oh . . . 20 times as fast? We can't really answer that because we haven't yet learned how to plumb a bird's mind. But we do know something about those feathery creatures with which we have to share the sky, and with which we occasionally have traumatic and even fatal (for both parties) encounters. Herewith, then, are a few things you ought to know about birds, if you are going to share their domain. ★



Odd Strikes

- A Snake at 3000 AGL
- A chicken at 800 AGL
- A Mouse at 8000 AGL
- A Flying Squirrel at 5000 AGL





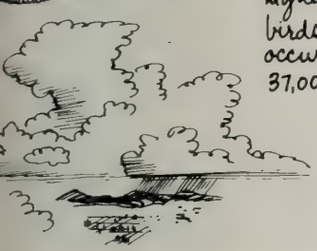
In 1974 there were 465 reported birdstrikes







The highest birdstrike occurred at 37,000 feet.





Several Air Force bases are built right in the center of bird breeding or nesting grounds or on migratory routes.



There have been 3 birdstrike accidents per year since 1969.

Birdstrike rates per landing/sortie/hour have all at least doubled since 1969





The smallest bird in the world is the bee hummingbird. It weighs 1/10th of an ounce.



Since 1964 there have been an average of 350 birdstrikes per year

TRACALS ENHANCEMENT



LT COL BRIAN T. GUBLER
Air Force Communications Service
Richards-Gebaur AFB, MO

During 1974 there were more than 14 million air traffic control (ATC) operations throughout the world. An ATC operation is a takeoff, landing or missed approach and go-around. Fifty-five percent of all USAF aircraft accidents occur during these phases of flight, which puts the air traffic control functions right at the heart of the Air Force accident prevention effort.

Air Force Communications Service is responsible for Air Force air traffic control support. This represents a sizeable investment in both men and equipment. The resources involved take the form of ATC radars, ILS, TACANs, VORs, and ground-air-ground communications systems. These systems compose what is referred to within the Air Force as traffic control and landing systems (TRACALS). Because of the complexity of TRACALS, the ATC environment, and the procedures necessary for performing the ATC mission, management at all levels must have a means of evaluating the performance of the composite TRACALS. Four distinct tools have been established to enable management personnel to assess ATC mission performance and effectiveness. These tools are TRACALS evaluation, operational evaluation, ATC analysis and AFCS flight inspection.

Operational Evaluation. The primary function of the operational evaluation program is to evaluate the service provided to the user. It is essentially a quality control tool for air traffic control personnel, concentrating on ATC procedures and phraseology. Each base having ATC responsibilities is evaluated on a 60-90 day interval by trained Air Force flight crews thoroughly versed on ATC procedures. Each check involves a thorough assessment of the service provided, including response to simulated emergency situations, and normally involves a single sortie. The information normally derived consists of overall service provided the user, controller proficiency, adequacy of controller training programs, and feedback on procedures. In addition, all aircraft used for operational evaluation are equipped with a Navigational Aids Flight Inspection System (NAFIS) and have highly trained technicians aboard to carefully interpret and evaluate the accuracy and quality of the signals radiated by the local TACAN, VOR, and ILS. Many flight safety items have been identified and corrected over the years, as a result of operational evaluations.

ATC Analysis: This program, managed and conducted by AFCS, involves a thorough operational assessment/analysis of the ATC environment at a given location. ATC analysis visits are normally conducted at 18-month intervals. A typical ATC analysis team looks at all factors affecting ATC operations at a given base, including terminal instrument approach procedures (TERPS), FAA coordination procedures, facility procedures, base operations interface and a review of the operational mission and unique procedures



ATC radar antenna (FPN-47) alignment check during TRACALS evaluation.

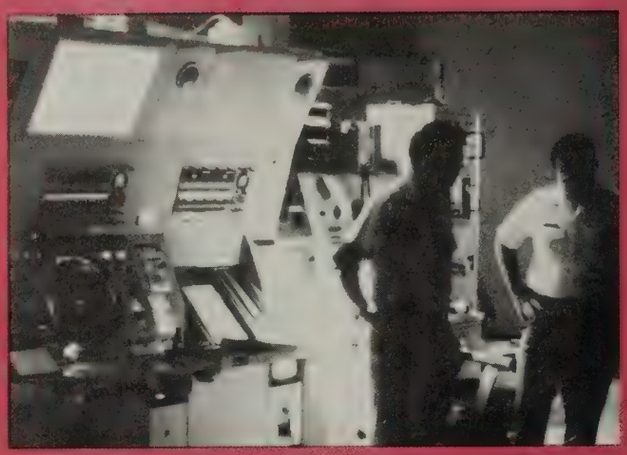


Theodolite check during flight inspection or TRACALS evaluation. C-140 aircraft.

that are used to accomplish it. Inasmuch as this is an analysis, personnel at the unit level are encouraged to bring out problems that confront the facility, so that solutions may be found. An ATC operational evaluation is conducted during an ATC analysis. This provides an opportunity to review facility procedures during a controlled situation with simulated emergencies. Reports generated by an ATC analysis are applicable to base units as well as the AFCS unit.

AFCS Flight Check. Flight check programs provide airborne platforms for evaluating actual accuracy and usability of TRACALS facilities. Experience has shown that electronic air navigation aids do not always provide accurate information to the aircraft even when ground measurement of the equipment indicates normal operation. This may be due to terrain interference, man-made obstructions or electronic interference. Periodic flight checks are conducted to detect deviations from established standards and to maintain the best possible quality of performance.

over



Rapcon
ATC analysis visit



TRACALS evaluation planning
session 1866 FCS, R-GAFB, MO.



Out briefing of conclusion
of TRACALS evaluation.



The job is not finished
until the paperwork is done.

AFCS flight check is employed primarily in support of mobile communications groups in conjunction with exercise and actual deployments of their TRACALS. Flight check has a continuing mission involving emergency mission support (EMS) of mobile TRACALS in a hostile environment. AFCS aircraft and crews performed flight inspections of all TRACALS in Southeast Asia throughout the Vietnam conflict. Maintenance assist missions are also flown at the request of AFCS units having problems that cannot be effectively solved without the use of flight inspection equipped aircraft.

TRACALS Evaluation. The TRACALS Evaluation Program provides an in depth technical evaluation of TRACALS facilities in their installed environment. The evaluations involve a ground and airborne phase using both ground equipment and airborne NAFIS equipped flight check airplanes. The objective is to optimize system performance/configuration and to define the capabilities and limitations of the facility equipment in its installed environment. Provisions are also made for special evaluations to solve problems that are beyond the capability of the local unit.

These are the various evaluation/analysis programs that are available to the ATC manager. Each supplies information to assess system effectiveness. Without feedback provided by these programs, the ATC manager would be hard pressed to determine the performance of his system. ★

A PILOT VISITS THE ENGINE TEST CELL



Checking test cell engine instruments for engine vibration while performing the operational check.



Sergeant explaining the engine breather check out, what causes engine excessive breathing.



Along with ear protectors, pilot receives a briefing on noise level in test cell.

I had to shut down an engine on two different flights during the past four weeks. This made me quite aware of engine maintenance; so when I had a free day I decided to pay a visit to our local engine test cell and watch the technicians testing an engine before sending it in for repair.

It so happened that this engine had been removed from the aircraft because of excessive oil consumption. When I arrived the test cell supervisor gave me a briefing on safety and presented me with a set of ear protectors to use during my visit. He then described some of the procedures they use, stressing that it is extremely important for engine test personnel to be thoroughly familiar with normal engine starting and operating procedures. They always ensure adequate people are available and firefighting equipment is ready for immediate use.

An outside observer with a headset connected to the test cell interphone is required during all phases of engine operation.

The test cell tests engines to evaluate the quality of maintenance and engine performance. Test cell personnel perform minor maintenance and make adjustments to engines to ensure the best possible performance, and they record the data necessary to determine engine condition. The test cell technicians must be sure engines are installed and operated in the test cell in accordance with tech data, and that all performance data is collected and prepared. The supervisor also must ensure the tools used in test cell operations are accounted for to prevent foreign object damage.

The accuracy of the instruments used to measure the various engine parameters during an engine test run must be known, which means that test cell equipment calibrations must be timely and completed on site when possible. Engine acceptance or rejection is meaningless when it is based on instrument reading of unknown accuracy; therefore, proper instrument calibration is essential.

During an engine test cell run, a vibration check is accomplished. This check provides maintenance with an indication of the engine condition by monitoring vibrations at four selected points on the engine while the engine is operated from idle to military rated thrust. Vibration meter readings are taken during acceleration and deceleration. If any excessive vibration is observed, the rpm is stabilized at that point and a steady vibration check made. On the J57-19W engine the pickups are inlet case, diffuser case, turbine case, and accessory drive adapter. On the engine I watched being tested all vibration levels were within limits so the check was completed.

A breather system pressurizing procedure (altitude simulation) which simulates breather system flight pressure is used to investigate the cause of excessive oil consumption or a sudden increase in engine oil consumption. It is also used in conjunction with the breather pressure check to determine if the breather system relief valve is working correctly. During the excessive breather pressure isolation check the breather pressure remained high. The chief explained that the most probable cause was a leaking main shaft carbon seal. Now that the engine test had discovered a cause for the malfunction, the engine will be sent to the engine shop for repair.

This repair is made easier and the engines will perform better because the people who work on the test cell have done their job. ★

FOD FOD FOD FOD AT ALL LEVELS

CAPTAIN JON R. NEW
Directorate of Aerospace Safety

Foreign objects come from many sources and are often unidentifiable. That is to say an engine can be seriously damaged by an object that we can't identify by name or source. Perhaps it was a pair of pliers left in an inlet, or a checklist, or ear muffs, etc.

Usually when we talk about FOD we think of the day-to-day problems that arise in terms of the flightline environment. Now we'll review some problems which had their origin at depot and/or contractor facilities. Review of these cases indicates that foreign object control is a problem that extends from the contractor or depot facilities all the way to unit level. Review the April 1975 issue of AEROSPACE SAFETY for insight into what depots find (normally unreported) during engine overhaul.

Inadequate or improper compliance with established maintenance procedures allowed a foreign object, an NR 10-32, 12 point nut to enter the engine oil system. This caused inflight engine seizure and loss of a single engine fighter aircraft.

After an FCF on a zero time engine, following an engine change during contractor overhaul, the postflight inspection discovered $16,930 worth of FOD to nr 3 engine. Investigation revealed that the contractor did not exercise adequate FOD control during engine change.

A small piece of brown paper towel or packaging material was left in nr 4 main tank during IRAN facility maintenance. The piece of paper became lodged in the fuel boost pump valve and caused continuous inflight venting of fuel.

A piece of cheesecloth left in the nr 2 main tank during depot maintenance deteriorated and the resulting fragments of material collecting on the boost pump intake screen formed a restriction which would not permit sufficient fuel passage. Fortunately, this was a multi-engine aircraft. Unfortunately, it occurred at Guam. Fortunately, well, you know the sequence, but this one ended fortunately.

During a go-around for a missed approach, the tanker nose gear hung in an intermediate position. A high shear rivet lodged at the bottom fulcrum point of a lock retention actuator. The rivet had never been driven and is normally a depot level item. It showed signs of having been through corrosion control aboard the aircraft. It is suspected the rivet was dropped during work and eventually worked into a position to jam the nose gear.

During an AB climb portion of an FCF, the nr 1 engine stalled twice, then flamed out. During the subsequent investigation, an 8/32 bolt was discovered missing from the ECM cannon plug bracket which was installed during a speedline mod. The bolt was worth $40,000 —in damages.

A reconnaissance aircraft was flying FCF after acceptance from an IRAN facility. Flight control problems were encountered (left roll) but they cleared during deceleration. Later, several panels were discovered improperly fastened and a panel seal had jammed the lateral control bellcrank rod end. These panels had not been opened since IRAN. A phillips screwdriver was also found wedged under the back seat on this same aircraft.

A pair of pliers lodged in the slat linkage just prior to takeoff. Investigation revealed that they were probably left in the outer wing panel during manufacture.

None of the foregoing examples had fatalities but the potential for a fatal accident existed in each case, and FOD has claimed its share of lives.

It is the individual worker who performs the work on the aircraft who has to take the precautions. Most of the work done at the depots and contractor facilities is good. But we all must take extra effort to ensure that the tremendous pressure to complete the job does not degrade the quality of our work. If your son or best friend were to fly the plane you worked on today, would you have done anything differently? ★

STUBBED RUNWAY TOES

LT COL ROBERT J. BRUN
Directorate of
Aerospace Safety



Back in the early days when there were a lot of Gooney Birds in civil and military fleets, I remember seeing a pilot from the former group discover and bemoan the reason for the persistent five-degree right bank his machine developed immediately after his precision two-point landing "right on the numbers." Unfortunately he had been less than precise and stubbed the right gear on the toe of the newly-commissioned runway extension. The tire took the impact okay but the gear rotated aft sufficiently to produce the five-degree list and a bulge in the upper wing skin where the drag brace retreated rearward and upward.

One of our Air Force pilots blunted his career and a four-engine transport in almost identical fashion a few years ago. One difference was that he was more precise—the wings were perfectly level—and he parked both main gear assemblies against the forward edge of the new runway extension and "rolled out" on the belly and nose gear.

Along came jet equipment and its nearly-constant pitch attitude and final approach sight picture which should have reduced the number of short landings dramatically and virtually eliminated the category for these aircraft. For a variety of reasons, which probably includes pride, visual illusion problems and plain misjudgment, they continued to occur.

A C-135 type aircraft was recently involved in an undershoot accident when the right seat pilot tried to salvage an erratic approach. The wing-wagging final terminated in a cloud of dust and the aircraft came up onto the runway at a decided angle to the centerline. The parts-replaced list included an engine pylon and two tires on the main gear.

A jumbo jet was damaged in a short landing when the pilot cut it a little too thin during a landing on a minimal runway with an overwater final approach. The touchdown was on an embankment, 20 feet short and 30 inches below the threshold.

Studies resulting from this last accident reiterate the dangers associated with the flat final and the importance of establishing and holding a stabilized final approach slot. Comparative figures used to illustrate this point show that in a large jet transport the main gear touchdown point is 1600 feet behind the pilot's aim point on a flat approach (1.5 degrees). Some additional approach angle figures are provided in the table. These figures show beyond a doubt that flying a flat approach in a big airplane can get you in a heap of trouble. While avoidance is the logical and perfect answer, the real world solution is *early* recognition and reaction to approach irregularities and the willingness to go around when it's called for.

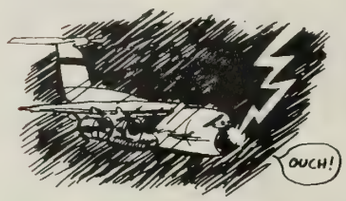
The odds against salvaging a bad approach on short final vary directly with the size of the aircraft, so the decision not to flirt with the approach overrun during landing should be made early—like before takeoff. ★

TABLE

GLIDE SLOPE ANGLE (DEGREES)	PILOT'S AIM POINT ON RWY (FEET)	MAIN GEAR HEIGHT OVER RWY THRESHOLD
1.5	1000	−14.8
1.5	1500	− 1.7
1.5	2000	11.4
2.5	1000	2.6
2.5	1500	24.4
2.5	2000	46.2
3.5	1000	20.2
3.5	1500	50.7
3.5	2000	81.0

OPS TOPICS

GOTCHA!



A C-141 was making a direct approach to an overseas airport. The AC had requested clearance to deviate to avoid buildups during descent but clearance was refused due to lack of radar contact by controller. The AC did deviate sufficiently to avoid the heaviest cells but he was unable to avoid the last storm in the line. The aircraft encountered moderate turbulence and heavy rain, and sustained a lightning strike. Damage included a football-size dent in the radome, wing skin damage, and numerous small holes in the radome.

SCRATCH TWO TANKS



AB-52D lost its tip tanks when the pilot inadvertently activated the tank jettison switch instead of the nr 8 hydraulic pack switch. The pilot was attempting to accomplish pack failure procedures in a dark area (several of the lights were inoperative) without transferring control of the aircraft or using a flashlight or checklist. Because of the darkness and the fact that the safety wire on the jettison switch was broken, the pilot did not recognize his error.

HIGH SPEED DIVE—OVER G!

During an ACM mission, an F-4 entered a nose-low high-speed dive. During the recovery the pilot loaded the aircraft to 10 G. The damage included engine mount failure, utility hydraulic and nr 2 oil system failure. The engine dropped to the engine bay stress panels causing sheet metal damage.

IMPROPER TENSION ON ARRESTING CABLES



A serious incident not long ago was the result of improper tension on a BAK-12 cable. A flight of four F-106's took off over a loose cable. The cable bounced and in each case damaged the nr 2 aircraft in the element. The second element wing aircraft was seriously damaged when the cable tore off the left main landing gear door and punctured a large hole in the main wing fuel tank. The subsequent investigation brought to light the fact that the aircrews were not aware of the hazards of an improperly tensioned arresting cable.

A-37 CARGO PROBLEM



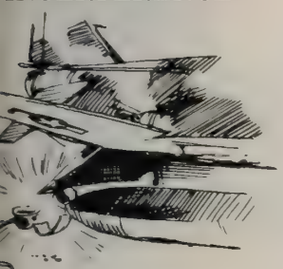
When the pilot retarded the throttles at level-off, the right engine flamed out. The engine was restarted but flamed out twice more before landing. A clothes bag of extremely thin material had seeped out around the edge of the nose compartment door, even thought the door was properly locked. This bag disrupted the airflow to the engine.

COCKPIT CLEARANCE

A T-38 pilot was forced to make a very high speed (200 kts) emergency landing because aft stick travel was restricted. During a negative G maneuver the rear cockpit seat kit came loose and jammed the stick (just as advertised in the warning on page 2-1 of TO 1T-38A-1).

OPS TOPICS

AILERON/HEADSET INTERFERENCE



The RF-4 was preparing for the second leg of an out-and-back mission. The pilot briefed the crew chief on proper launch procedures. During flight control check the crew discovered a discrepancy. While the AC considered the discrepancy, the crew chief went under the aileron without notifying the AC. The AC then recycled the ailerons catching the crew chief's headset between the aileron and the outboard tank. He pulled free but his headset damaged the aileron.

CONTROL ICE



A T-39 was on an admin support flight, cruising at FL390. While at that altitude the flight controls froze and the elevators could not be moved. The ailerons were unaffected. Since the crew suspected ice, they diverted to a southern base where the air was warmer. Descent was controlled by power, trim, flaps and speed brakes to 2000 feet AGL. The aircraft circled the divert base for approximately 45 minutes while the controls became progressively freer. By the time fuel depletion forced a landing the controls were almost normal. The crew flew a flat power-on approach at computed speed plus 15 knots. All available elevator and trim were required to hold the nose up for landing. The probable cause was water accumulation in the cockpit flight control area. There is now a change to the dash-1 to include the cockpit drain valve as one of the pilot's preflight items.

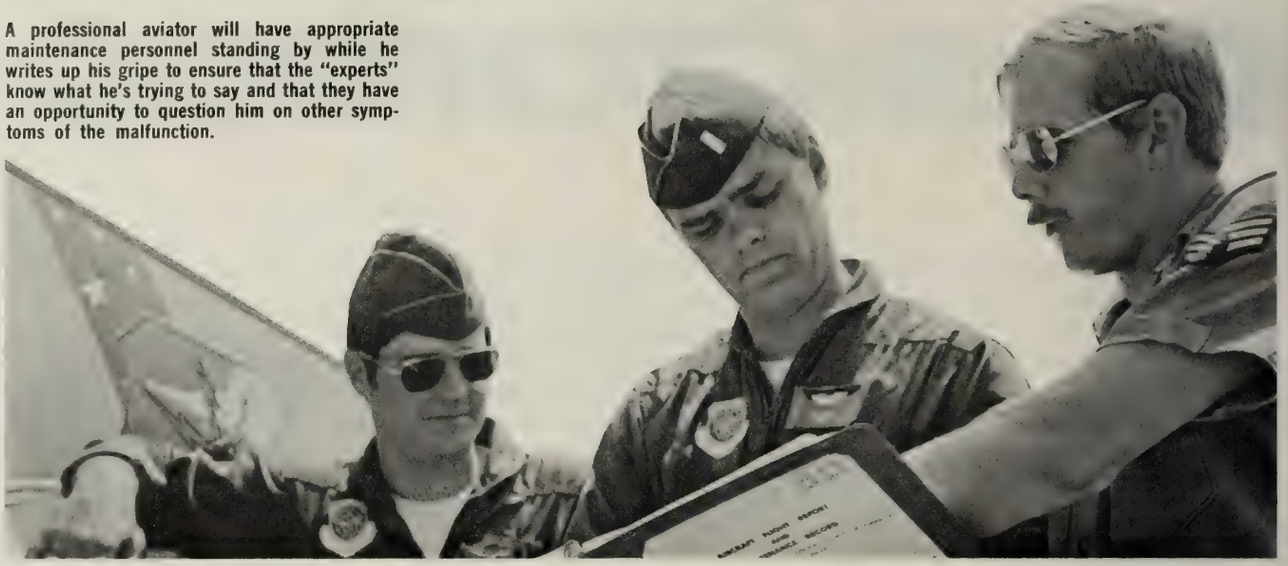
FOD IN THE COCKPIT

An F-4 landed after a range mission, at which time the stick stopped approximately 3 inches from full aft stick travel. Maintenance troubleshooters found two press to test light covers in the aft stick linkage well. It is probable that they had been there for quite a while, since there was no history of maintenance in the stick well. ★

FLIP NOTE

A section of the FLIP (Enroute) IFR Supplement was recently devoted to Pilot-to-Dispatcher (PTD) facilities. It is designed to provide pilots with procedures, capabilities and standards appropriate to the PTD facility. PTD provides effective communication which is often attempted through misuse of air traffic control frequencies. Read your FLIP so you will not interfere with the primary duties of the air traffic controller or be caught in the "I didn't know that" syndrome. Make the PTD facility work for you. Additional information on this subject was published in the TIG Brief, Volume 16, 29 Aug 75.

DON'T BE A ROADBLOCK



A professional aviator will have appropriate maintenance personnel standing by while he writes up his gripe to ensure that the "experts" know what he's trying to say and that they have an opportunity to question him on other symptoms of the malfunction.

The AF 781 serves several purposes one of which is extremely important to aircrews. It is a tool by which the aircrew can assure that aircraft deficiencies are properly corrected by telling maintenance what the problem is. This will help ensure long life and well-being for the aircrew.

When a system malfunctions in flight the observations of the crew are usually very important to the diagnosis of the trouble and its repair by maintenance. The more detailed and precise the write up by the crew, the better the corrective action. We've known this for many years but still we get vague, incomplete descriptions. To aircrews this is bad news because that is one of the reasons why we see such remarks on the 781 as "ground checks okay."

It is the flight crew's responsibility to include a complete description of the problem. It is the responsibility of maintenance to correct the malfunction and provide the flight crew with a reliable system. This calls for a high degree of cooperation between the flight crew and maintenance technician, to achieve maximum equipment performance. The maintenance technician must question the flight crew's write ups, not for validity but for completeness. In turn, the flight crew must question the maintenance man's corrective actions concerning a malfunction.

The flight crew's most frequent question is, "why should the technician have to question the flight crew's 781 write up?" We can best answer this question by tracing the technician's procedures for repairing the system.

When the technician receives the discrepancy, his first action is to research past history on that aircraft and system. This will help to prevent the same unit being replaced several times, to correct a repeat malfunction when the trouble was actually caused by another unit. After he has analyzed the problems, the technician must start troubleshooting the system. In the avionics systems this can take many hours before the cause of the malfunction is located. This is where a good 781 write up by the flight crew can reduce the technician's workload. If the discrepancy was written up as "UHF inop" the technician doesn't have much to go on toward solving the problem. Now, if the discrepancy was written up as "UHF transmitter intermittent on both preset and manual, sidetone weak, distance to ground facility 80 NM, all positions affected," the flight crew has saved the technician valuable troubleshooting time. The problem was limited to a specific area. It ensured that the correct cause would be found, not a related malfunction.

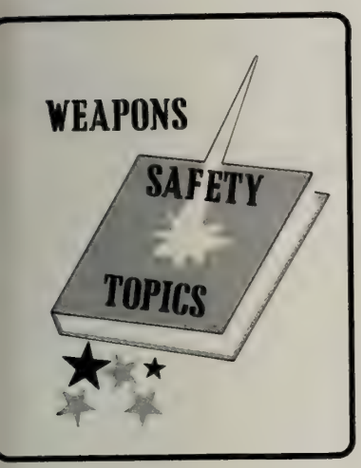
By asking questions, the flight crew will increase their understanding of how the system works and can provide maintenance technicians with a more accurate and detailed description of the problem. If the system is repaired correctly the first time, the flight crew has a reliable system that will be trouble free longer.

It is said that communication is a two way street. Don't be a roadblock to good maintenance. ★



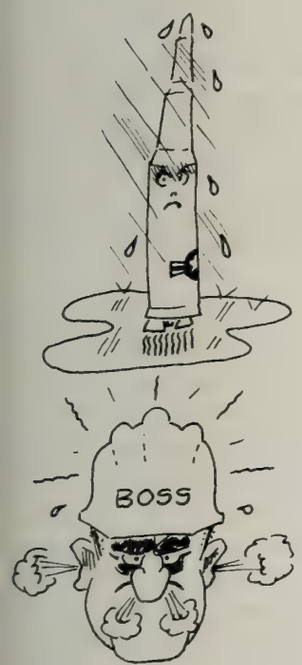
NAME CHANGE

Since December 1974, Missile Topics have been featured in AEROSPACE SAFETY. These recurring articles were devoted solely to USAF ICBM systems, space boosters and probes. Due to the recent AFISC reorganization, Missile Topics has been replaced by Weapons Safety Topics. There will be no great change in the type of material covered; current safety problems, past and present lessons learned, and other pertinent safety matters; only an expansion to include air launch missiles, drones, and explosives. Communication continues to be the purpose, with the goal being "zero" accidents and incidents records.



20MM AMMUNITION LOT NUMBER CONFUSION

A recent explosives accident highlighted the confusion that exists and has caused misidentification of suspended or restricted lots of 20mm ammunition. Identification of 20mm M14A2 links of the BLM-1 series is unique in that they are stamped with a "heat" lot number that is similar to the true link lot number. For example, 20mm ammunition lot LCL-24-734 was linked with links from link lot BLM-1-36, yet the links were marked with the heat lot number BLM-1-9, BLM-1-10, etc. The true link lot number was shown only on the shipping container and lot data cards. All other lots of BLM-2 series and BLM-3 series are correctly identified with the true link lot number on the link. The referenced accident occurred when experienced munitions personnel, who were not aware of the unique identification procedures for BLM-1 links, accepted a restricted lot as serviceable by comparing the numbers on the link with those in TO 11A-1-1. They should have obtained proper identification of BLM-1 series links as addressed by a note in TO 11A13-4-7, Table 5-1. When doubt, contact the Ogden ALC item technician for positive identification.



RV-G&C VAN ENVIRONMENTAL FLAP SEALS

In 1971, rain intrusion, due to deteriorated "V" van seals, was cited as a cause factor in two Minuteman wet missiles. The condition was fleet wide and had been overlooked because of inadequate Dash Six Inspection practices. A large-scale replacement of van seals became necessary. Recently, we have seen indications that the seal situation is cropping up again so we suggest you take a close look at your "V" vans. Incidentally, the seals on payload transporters look OK.

THINGS MUST GET DONE—TIMELY AND CORRECTLY

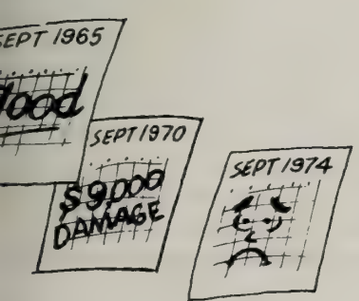
Sometimes in our efforts to get our work done, we proceed in haste and waste results. Such was the case of a recent missile incident. In attempting to remove binding securing screws from the safe-arm access doors to the pen-aid spacer, a team chief went beyond technical data and did not request job control assistance in his zeal to get the job accomplished. Because of problems with breaking bits, he utilized a pair of vice grips to remove the binding screws after cutting the cork ablative material. Although he did accomplish the task, damage to the pen-aid spacer resulted in an unnecessary expenditure of manpower and material. The lesson learned is simply—follow technical data and request assistance from job control.

LEST WE FORGET

Ten years ago we had an extremely good month.

Five years ago, materiel failure of the Guidance and Control (G&C) chiller motor (shorting to ground) caused an electrical spike through the grounding system resulting in approximately $9,000 damage.

One year ago, personnel error by an RV maintenance team resulted in the ball locks not being properly locked between the R/V and the lightweight spacer. When torque was applied, damage occurred because the tubing inside the spacer was forced against the longerons (holes where the tubing passes). ★



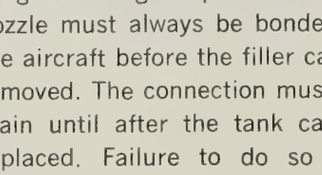
tech topics

grounding



The crew chief was inserting the refueling nozzle into the left wing tank refueling receptacle of a T-37 when the fuel ignited. He immediately removed the refueling nozzle from the receptacle and extinguished the fire. When over-the-wing servicing is performed the nozzle must always be bonded to the aircraft before the filler cap is removed. The connection must remain until after the tank cap is replaced. Failure to do so can cause a static spark at the tank filler. Everyone should keep in mind that there is no task so urgent that good, sound maintenance and safety standards should be disregarded. Supervisors must ensure that everyone involved in refueling operations is thoroughly familiar with and qualified to perform his tasks.

wanta buy a pin?



"Stop me, if you've heard this one." While an F-4 was being dearmed after landing, one of the dearm crew started to pass the gun firing circuit safety pin to the team chief. The transfer didn't take place because the engine gobbled the pin. Personnel error was assessed as the cause because the action took place too close to the engine intake.

P.S. This was an expensive goof . . . like $46,000.

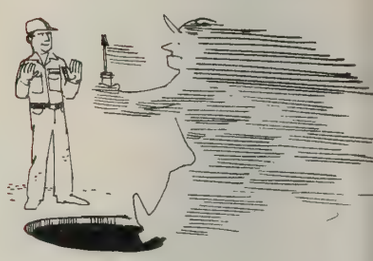
FOD, quick check, etc.



Sometimes ya wonder why so much FOD? It's expensive at the very least, colossally expensive at worst and a killer to boot. So why can't we get rid of it? One reason is that people who may be very conscientious most of the time can get a bit careless or forgetful and as a result thousands of dollars can go down the drain. Here are a couple of examples of FOD in F-4 engines; total cost $22,000 +. During the pilot's preflight, he removed the front cockpit camera scope dust cover and handed it to the maintenance man assisting him to strap in. The WSO of another F-4 was preflighting and he removed the canopy jury strut and handed it to the maintenance man assisting him strap in. In the two incidents the dust cover and jury strut were placed on top of the left engine inlet while the maintenance men continued to assist the flight crew members. The dust cover was ingested into the left engine as the pilot was advancing throttles to afterburner during takeoff. The right engine was damaged by debris from the left.

The jury strut was ingested sometime between engine start and engine runup check. The crew chiefs did not notice the items during engine start. Flight crews failed to detect them and the quick check ground crew missed them. After thought: Wonder how good our preflight and quick check inspections really are.

hurry hurry



Numerous incidents occur daily because incorrect procedures are used, for example, FOD to the left engine of an F-4. The left windshield panel was replaced. A short 10/32 screw was used where longer screws are required. The shorter screws came loose during flight and were ingested by the engine.

A B-52 had just taken off when nr 2 engine fire warning light came on. The pilot had to shut down nrs 1 and 2 engines. The wrong type V band clamp had been used to connect the pneumatic duct to the starter control valve.

Another B-52 was on climbout when nr 8 engine fire warning light came on. The engine was shut down. After landing, maintenance found a 450° fire detector installed where a 550° one should have been.

Supervisors can play a major part in solving this problem by stressing quality instead of quantity. Everyone realizes that the tendency to rush is great, and those aircraft on the ground don't help the time line, but a job hurried and done incorrectly only has to be redone. Every maintenance technician has a responsibility to provide the aircrew with the best possible aircraft available and with just a little effort on everyone's part it can be done.

shift change



One more round for the old shift change goblin. During preflight of an A-37 for a scheduled takeoff time, a fuel seepage was detected at both wing root areas. It was determined that the aircraft was flyable and the 781 form was properly documented. Later that morning when a fuel system specialist became available he was dispatched to repair the fuel seepage. He opened the rear hoist access panels and sealed the seepage but did not secure the panels; however, he did document the panel discrepancies in the 781A on two red Xs. The specialist was completing the work right at shift change and neither the crew chief nor flightline expediter was readily available to check out with. After shift change no one returned to the aircraft for a status check after completion of maintenance. The launch crew chief and pilot arrived at the aircraft at the same time for final launch preparation and preflight. The pilot reviewed the forms but failed to detect the lack of corrective action for the access panels being open and did not notice the exceptional release was invalid since the red X entries were below the red line in the 781A. During preflight walk around and the end of runway check no one detected the unsecured panels. After the flight the panels were discovered missing. 'Wonder where they fell?

same song

Sometimes we grow a bit weary of beating the tech data drum, but the beat is going to be the same as long as we play the same tune. The song always ends with the words "failed to follow tech data." The rest of the song describes an accident or incident. Here are a few songs randomly selected from recent releases.

A BDU-33 practice bomb was being unloaded from a SUU-21 bomb dispenser. When the bomb from station 5 was being removed it slipped from the grasp of the handler, fell to the ramp and functioned on impact.

Cause: Improper use of tech data. The MD-1 loading unit was not used as required by technical data.

* * *

An AIM-7 missile on an F-4E would not tune, so specialists replaced the TG-213 tuning drive but the problem still existed. A sergeant who obviously didn't know what he was doing decided to tap the nose cone with a rubber hammer. The idea was to unstick a relay located about 18 inches from the nose. He tapped until he shattered the nose cone.

Cause: Improper use of "tech data."

* * *

There were three LUU-2B flares ejected from an SUU-35C/A because maintenance personnel did not assure that the firing leads had been disconnected.

It has been the Air Force policy to instill in the minds of maintenance people to "follow technical data." During the everyday grind of launch, recovery, return to OR status and launch again, there may be a tendency to deviate from technical data. It is the managers' and supervisors' responsibility to assure proper use of tech data. Failure to do so can and will result in incidents such as those related here.

chafing hose



The KC-135 had been airborne for 30 minutes when the nr 1 hydraulic pump inop light came on. That pump was isolated. Thirty minutes later the left system quantity began decreasing. The mission was aborted and the landing gear lowered manually. The pilot did not use crossover because of fluid loss and for fear of contaminating the right system. Chafing of the exterior metal sheathing of the nr 1 engine driven hydraulic pump lower pressure hose was the cause. Proper clamping would have prevented this incident and saved $2,117.00.

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Captain
WALTER L. VAN GILDER



*Captain
NICHOLAS H. HOBBIE, JR.

*CAPTAIN HOBBIE LOST HIS LIFE IN AN AIRCRAFT ACCIDENT SHORTLY AFTER THE INCIDENT RELATED HERE.



Captain
MICHAEL L. BRAZELTON



Major
RALPH A. RIDDELL



Captain
DARL L. STEPHENSON

64th Fighter Weapons Squadron, Nellis AFB, Nevada

On 6 December 1974, Captain Hobbie was flying as an Instructor Pilot in the rear cockpit of a T-38 with Captain Van Gilder in the front cockpit. A three-ship sortie was being flown as an air combat tactics upgrade mission. While initiating an unloading extension maneuver to gain airspeed, Captain Van Gilder's ejection system malfunctioned, opening his lap belt, firing the man-seat separator and filling the front cockpit with smoke. Captain Van Gilder was violently thrown against the canopy and the survival kit on which he was sitting was thrust forward against the control stick and held there. The oxygen hose, G-suit and communications cord were disconnected in the process, eliminating communications for the remainder of the flight. Observing these events, plus the erratic diving motion of the aircraft, Captain Hobbie took control and attempted to regain level flight. This required the use of both hands in that he was pulling against the combined weight of Captain Van Gilder and the survival kit which were wedged against the front control stick. Captain Van Gilder was immobilized in this position and unable to render any assistance to Captain Hobbie other than to push back against the seat kit to give Captain Hobbie an additional one half inch of stick travel. To compound an already desperate situation, Captain Hobbie's cockpit had been modified with a stress recorder and contained no flight or engine instruments whatsoever. Captain Hobbie initiated a direct return to base and notified the GCI site and other flight members of the situation. Captain Stephenson, the GCI controller, immediately vectored the other T-38s, flown by Major Riddell and Captain Brazelton, toward the emergency aircraft and notified ATC agencies and the base of the inbound emergency. A successful rejoin by Major Riddell was accomplished 20 miles north of the field. During the rejoin, Captain Brazelton went off frequency to call all controlling agencies in order to clear the recovery airspace of conflicting traffic and to ensure both runways at Nellis AFB were available, since all three aircraft were now critically low on fuel and would have to land immediately. With Major Riddell calling off airspeeds and altitude over the radio, Captain Hobbie performed a controllability check and determined that he would have to make a no flap approach at an airspeed greater than 200 knots. A flat approach was flown with Major Riddell continuing to call off airspeeds. Captain Hobbie successfully landed the aircraft and rolled to a safe stop on the runway. The quick reaction of these officers in an extreme emergency and their skill in executing a flawless recovery resulted in the saving of a valuable aircraft and more important, the life of a crew member. WELL DONE! ★

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SAFETY OCTOBER 1975



OCT 27 1975
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UNITED STATES AIR FORCE OCTOBER 1975



YC-15 advanced medium STOL transport protype shown during takeoff on first flight, August 26.

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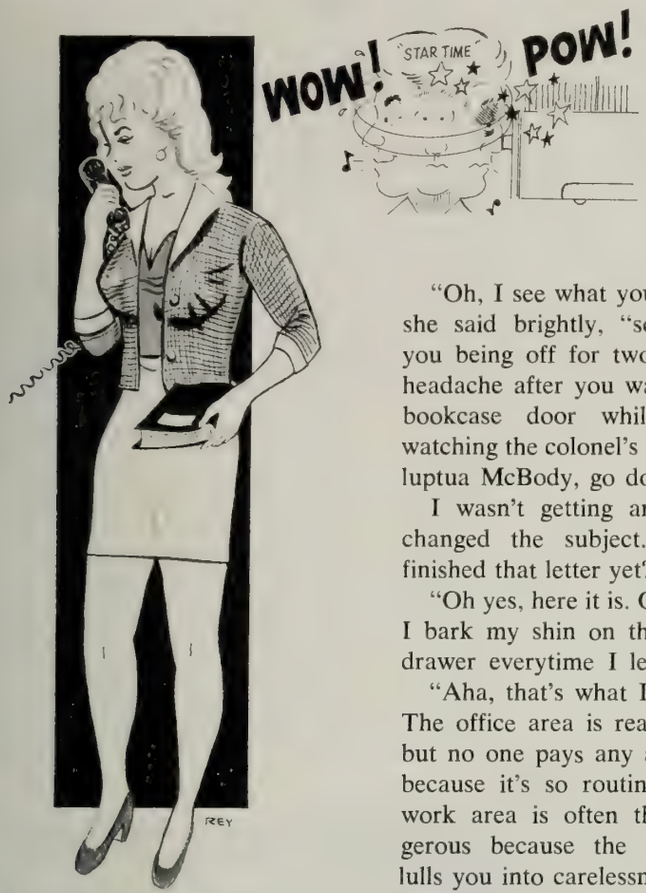
DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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OCTOBER 1975 AFRP 127-2 VOLUME 31 NUMBER 10

SAFETY STARTS AT YOUR DESK

MAJOR PHILIP E. CATON, Directorate of Inspection



Miss Backspace looked up from her typewriter and said, "You know, Major Blank, I think it's really something how you fly all over the world to point out safety violations to Air Force people."

I thought a second and replied, "Well, Miss Backspace, you don't have to go TDY to find safety violations or careless practices. You can find some right in the office."

"Oh, I know about things like you falling off your swivel chair when you leaned back, but I mean big things."

"The chair incident was not what I had in mind, Miss Backspace," I said stiffly. "I was referring to accidents that impair your working effectiveness, like when you accidentally stapled your finger while rushing to put that late report together, and couldn't type for three days."

"Oh, I see what you mean now," she said brightly, "something like you being off for two days with a headache after you walked into the bookcase door while you were watching the colonel's secretary, Voluptua McBody, go down the hall."

I wasn't getting anywhere so I changed the subject. "Have you finished that letter yet?"

"Oh yes, here it is. Ouch! Darn it, I bark my shin on that open desk drawer everytime I leave it open."

"Aha, that's what I'm getting at. The office area is really hazardous but no one pays any attention to it because it's so routine. Your own work area is often the most dangerous because the routine often lulls you into carelessness."

Miss Backspace thought a moment, then said, "Yes, I can see where you could get a lost-time accident around the office."

I beamed at her; "Now that's specifically the point I was trying . . . What's the matter?"

"Nuggh!" Her face had rapidly turned red and she was making strange sounds through clenched teeth.

"I . . . my . . . oh . . . the typewriter . . . shelf . . . just dropped . . . on my knees!"

After I extricated her from her typewriter, she took a deep breath. "Boy, I guess I should have made sure that shelf was locked in place before I started using the typewriter."

"Right, you can't be too careful even in the office. Ooops! Why, hello, Miss McBody."

"Major, the bookcase!"

Crash! ★

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LANDINGS GOOD AND BAD

As the student pilot said when he crawled from the wreckage of his aircraft, "It's not flying that troubles me, it's landing." Landing has been troubling pilots for as long as airplanes have flown, and two problems associated with landing have been particularly troublesome. These are low visibility and wind shear.

A low visibility approach ranks with desk jobs and dental appointments on the low end of the pilot's popularity scale. However, since we must fly in less than optimum conditions much of the time, low visibility approach problems face all of us. The thing which leads to disaster on such an approach is the lack of visual clues to the runway environment and, therefore, lack of adequate glide path reference once the instrument approach has been abandoned.

Many things affect our ability to judge distance, glide angle and



the other parts of the approach. For example, we associate distance from the runway in terms of clarity and brightness of runway lights and the apparent size of the runway itself. We base our glide path on a perception of the touchdown zone we develop from visual cues and past experience. This works fine until some of the cues are not available. Then illusions can creep in. In marginal visibility conditions, extremely bright runway lights can cause the illusion that the aircraft is closer to the runway than it actually is.

As the low visibility eliminates more and more of the pilot's visual cues, it becomes extremely difficult to judge the proper glide path or rate of descent. As a result, the pilot often resorts to a maneuver known as "duck-under." In this maneuver the pilot lowers the nose of the aircraft and attempts to bring more of the visual cues to the runway environment into view. This decrease in pitch causes an increase in sink rate, which may exceed the ability of the pilot and aircraft to correct prior to ground impact.

The pilot may also be led into a "duck-under" when he attempts to use as much of the available runway as possible. A late transition from a non-precision approach to a steep visual final can mean a hard landing. Part of the problem is the reaction time needed for the pilot to transition effectively from instruments to visual references.

USAF Flight Dynamics Laboratory experiments indicate that it may take as long as five seconds for a pilot to transition from instruments to visual flight and derive meaningful data. This time is critical, because for a standard 3° glide slope at 100 feet AGL an aircraft is 1900 feet from the glidepath intercept point. That means that for an approach speed of 130 knots the pilot has a total of nine seconds to transition to visual references and execute a proper landing. Many modern jet engines require 6 seconds or more to accelerate from idle to military thrust. Thus, in our example if the pilot had executed a "duck-under" at 200 feet and then acquired the runway visually at 100 feet, it could require 11 seconds or more for him to execute a missed approach—a deficit of more than *three* seconds.

The best defense against these visual illusions and the "duck-under" is use of proper procedures. Stay on instruments until you have sufficient visual clues to adequately assess the proper glidepath. If you are flying a crew airplane, have the other crew member search for the runway and have the pilot doing the flying stay on the instruments. Or use the technique suggested in AFM 51-37, Chapter 18, have the





landings...good and bad continued

copilot fly the approach and the pilot take over when he has visually acquired the runway.

The other problem most often associated with a short or hard landing is wind shear. In the past two years at least two major accidents—one Air Force and the other air carrier—have been directly caused by wind shear. This is a particularly insidious problem because the pilot often has little or no information to suggest a shear exists. In fact it may not exist until seconds before the aircraft encounters it. This is true in the case of winds associated with thunderstorms. Wind shear causes problems because it affects the aircraft groundspeed and therefore the glidepath. Consider the case where a pilot flies the first portion of the ILS glidepath with a tailwind. His groundspeed will be higher, and in order to remain on glidepath he will have to reduce thrust and fly a steeper flight path angle. Now, if just after the aircraft reaches minimums (100-200 feet), the wind suddenly shifts to a headwind, the steep glide angle coupled with a low thrust condition can result in a short or hard landing. In the Air Force accident mentioned earlier, the aircraft was on a proper glidepath and airspeed yet, due to severe wind shift on final, the aircraft crashed 200 feet short despite maximum power.



Not all wind shear mishaps are as dramatic as this or that of a DC-9 which crashed seriously injuring several people. But wind shear has embarrassed more than one pilot over the years. The best defense against it is knowledge. If you know it's there, you are aware of the corrections necessary and you won't be caught over the overrun out of airspeed, altitude and ideas at the same time.

Douglas Aircraft Corporation recently summarized the problem of short or hard landings in a newsletter. They reviewed instrument approaches from many different types of aircraft and found that those which resulted in short or hard landings usually were the culmination of an unstable final approach (from approximately 1000 feet above threshold to touchdown).

An unstable approach is defined as one in which the pilot has been hurried prior to glide path interception and has trouble getting established on glide path. The first deviation is usually a large one above the glide path, followed by too large a correction with the aircraft going well below glide path. This oscillation continues unless the pilot takes positive action to dampen his corrections and smooth out the approach. In VMC this is not a serious problem, for the pilot can transition to a visual approach. However, if either low visibility or a wind shear exist, the unstable approach, if carried to the overrun area, will probably result in a less than optimum landing.

While we often associate the unstable approach with an inexperienced pilot, even the most qualified are vulnerable. Experience may be a function of currency. A 10,000 hour pilot who now spends most of his time behind a desk is very susceptible to this problem. Even the man who flies regularly, when fatigued can easily find himself involved in an unstable approach. Nonetheless, the solution is simple—if you aren't happy with the approach go around and try it again. ★

SPAD REUNION

The Annual A-1E/H Reunion will be held October 17-18, 1975, at the Menger Hotel in San Antonio, Texas. Spads, Sandys, Hobos, Fireflys, Zorros, spADs, Downed or Rescued Crewmembers, and any other interested parties are encouraged to attend. Send inquiries to the A-1 Skyraider Association, Box 41, Randolph AFB, Texas 78148.

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The Ambiguity Zone

TSGT JOHN D. MAY
Air Force Communications Service
Traffic Control and Landing Systems
(TRACALS) Evaluation Division
Richards-Gebaur AFB MO



You are flying along and decide to tune in a METRO station to get a weather report for your destination. You can hear the forecaster talking to another aircraft, but when you call you can't get an answer. Has this ever happened to you? Frustrating at times, isn't it? There may be a simple answer. You may be in a coverage area which I have chosen to call the ambiguity zone. This is where the capability of the ground-to-air (G/A) link exceeds the capability of the air-to-ground (A/G) link.

The reason for this is easily understood if you are aware of the capabilities of your aircraft communication equipment versus the ground communication equipment. The ground-to-air link includes the ground transmitter, its associated antennas and antenna coupling system and the airborne receiver and its coupling system. The air-to-ground link is similar but uses the airborne transmitter and ground receiver and the same antenna systems as the ground-to-air link. Normally, the ground equipment is more powerful than the airborne equipment.

The capability of a system is determined, in part, by the amount of power available to get the job done. The amount of power available is determined by the power output of the transmitter, how weak a signal the receiver will accept and still produce an audio output, the gain of the antennas used, losses or attenuation of the transmitted signal by free space attenuation and antenna coupling loss. For our purposes we are excluding system losses or gains because they are the same for each link. The airborne receiver requires a five microvolt or stronger signal to operate. The ground receiver will provide an audio output when the RF energy received is three microvolts or stronger. However, the increased sensitivity of the ground receiver does not compensate for the low power output of the airborne transmitter. Airborne transmitters provide 8 to 16 watts of RF power while ground transmitters normally provide 50 to 100 watts of RF power.

Using communications engineering formulas to convert the electrical parameters given above into coverage range gives the following results. A ground-to-air link using a 100 watt ground transmitter has a coverage range 37% greater than an air-to-ground link using an airborne transmitter (16 watts). For example, you are approaching an airbase and start hearing the METRO station talking to another plane. At the time this happens you are 200 NM away. You would have to approach to 126 NM before the forecaster could hear a transmission from you. Conversely, when going away from the facility, the forecaster would lose contact with you before you would stop hearing him.

Air Force Communications Service is currently evaluating communications equipment used in the Traffic Control and Landing Systems (TRACALS) environment. The G/A and A/G links are checked on a system basis by flight check aircraft from facility checking squadrons. While the ambiguity zone described in this article is based on theoretical data, evaluation results have shown that in day to day operation the amount of range difference between the two links fluctuates, and increases or decreases this ambiguity. For example, a recent evaluation conducted by a TRACALS evaluation team produced data that showed, for a particular location and date, the actual range difference was only 28% rather than the predicted 37%.

Ground communication stations need to know when you encounter any type of communication difficulty. This type feedback provides a performance assessment capability that can only serve to improve communication service. But remember, when you can't get an answer to your calls, although you can hear the ground station, it may be because you are in the ambiguity zone. ★



MY MOST DANGEROUS MISSION

CAPTAIN JAMES P. BLOOM
43 TFS
Elmendorf AFB, Alaska

The most dangerous mission I have flown did not take place while chasing Migs over Hanoi or sweeping past "Thud Ridge" enroute to a strike mission with a load of MK-82 bombs. The flight I am referring to was a Sunday morning cross-country with my wife and child to a "Fly In" breakfast. We did not fly in a blinding snow storm nor in a thick fog, but in deadly CAVU. The aircraft did not present a threat. Our (rented) Cherokee Arrow, 180 HP retractable gear aircraft worked as advertised. What could present a problem under these idyllic conditions? Pilot error!

The flight originated in Anchorage, Alaska, crossed the Alaskan Range mountains, through Sheep Mountain Pass and was to land on Lake Louise for the breakfast. This may sound strange, but it is not unusual to plow some snow off a frozen lake to accommodate wheeled aircraft operations during the winter.

To reach this destination, I as pilot and sole crewman did my homework very thoroughly. The latest maps were obtained, the course was plotted and measured. Prominent features were studied. High terrain was noted, emergency landing areas were marked, and fuel consumption was computed. Finally the ETE (estimated time enroute) was calculated. A very thorough flight plan evolved from this effort.

Sunday morning at last arrived, and it was time to put the flight plan to the test. We gathered our survival gear, as required by Alaskan law, which included a rifle, sleeping bags, signaling devices (flares and mirrors), matches, food,



and cold weather gear. The weight and balance showed us to be well within the allowable envelope. Next, a weather briefing was obtained from FAA—clear skies and 100 miles visibility, winds light and from the south. Beautiful, even a student pilot could handle this one. Now just fly the flight plan.

We filed our flight plan, and allowed for one-and-one half hours on the ground before returning. The gear was loaded, and I got the checklist and preflighted the plane thoroughly. Everything looked good, so we strapped into our Arrow, picked up the checklist, and went through each item. I started the engines, called "ground" and taxied out, and completed the before takeoff checks. The tower cleared me for takeoff.

Beautiful, we were off to breakfast. Airborne, I activate the fligtht plan, and call departure control for traffic advisories. When we approached Sheep Mountain pass I called for an update on enroute weather—no change and no turbulence in the pass. As I entered the pass, I kept to one side, which allows maximum room for a 180° turn in case the weather gets bad. We cleared the mountains, and our destination was just ahead. We let down and approached the field.



After let down I checked for traffic, and performed my landing checklist, double checked the gear. The only other aircraft in the pattern was a Maule on base. On downwind, I checked again, FUMP (fuel, undercarriage, mixture, prop), turned base and called my position. They sure moved a lot of snow, I thought to myself, at least 3,000

MY MOST DANGEROUS MISSION continued

feet. Gotta make it look good, there's a lot of people here. Pull the power off, let it sink, a little back pressure, wait for the mains to touch, and nothing. Then I realized I was still four feet above the runway. Instantly I added a little power and made my normal greased landing. Flaps-up, brakes on, and taxi off the runway. I made a mental note to watch for runways with snow banks piled up all the way down the runway, but now breakfast.

We parked the plane and joined our friends for the meal. Naturally, the talk turned to flying, and each pilot told a better story than the previous one. Most stories were told to impress other people with the balladier's skills and prowess in the air. Typical hangar flying. After my third cup of coffee, I looked at my watch, and found that my hour and a half ground time had already taken two hours. I had to hustle now to keep from getting farther behind schedule.

We hurried back to the aircraft, and while I did a quick preflight (nose, wings, tail, gear, and prop all there), my wife and son strapped in. I cranked the engines, sped through the checklist, and taxied out. When I arrived at the intersection of the runway and taxiway, I checked final, base, and downwind for traffic. There was a Cessna 150 on base, so I had time to go through the checklist before he landed. Finally the Cessna was down. I was going to take off opposite the direction of landing traffic, as there was no other traffic in the pattern and no wind, besides, all other aircraft had been taking off the way I had decided to go. I waited for the Cessna to taxi off the runway, but he stopped right on the runway. I waited, but he didn't move, and then I noticed his prop was stopped.

Since he decided to stop there, I figured to just take off over him. I added power and started the take-off roll. All the gauges were in the green, and then I realized that the 150 was a hell of a lot closer than I thought he was. Too late to abort. I tried a short field technique. Keep the nose down, 65 MPH, pull two notches of flaps. Pull up the nose and climb. I did it! I cleared the Cessna. It was only by twenty feet, but a miss was a mile.

Later I looked back and analyzed the entire situation. I planned and flew the first half of the mission in a professional manner, but after I completed that half, and joined my friends, I relaxed. I felt as though I had completed the trip even though it was only half over. During breakfast and "hangar flying" I let my ego grow and knew I would impress these people with my flying. This, coupled with my urgent desire to hurry back into the air and contact FAA to update my flight plan, blinded me to other options available.

These options could have been to taxi down to where the Cessna was stopped and take off in the direction of landing traffic. Another possibility could have been to taxi down to the other end of the runway instead of making an intersection departure; although everyone had been making intersection departures. I did not want to show I was any less adept than other pilots.

The lessons to be learned are three-fold. First, when you feel a false sense of pride growing—watch out! Trying to impress people with your flying is looking for trouble. Secondly, when you feel a strong need to hurry when flying, *SLOW DOWN*—force yourself to slow down. If you don't, you can skip critical steps in the checklist, and tune out information that may prove to be very important. In either of these states, however, your judgment becomes very impaired.

Finally, the last lesson to learn from this experience deals with perception. In other words, what you see may not be what you get. The Cessna 150 looked about 1,500 feet down the runway. I knew my plan could clear a 50-foot obstacle in 1,300 feet at maximum gross weight. The reason for this misjudgment was due to the very narrow runway and the four foot snow banks on both sides. It gave an illusion of the aircraft being much farther away. It was quite like a "magic box." This brings to mind an old saying, "Believe half of what you see."

Captain Bloom was fortunate. For several other Air Force personnel flying general aviation aircraft this year, luck ran out. A lieutenant and a civilian passenger were killed when the lieutenant allowed the Cessna 150 he had rented to stall and spin in. The two were flying low and slow in an area where the terrain elevation is 7400 feet.

In another recent accident two airmen died when their rented Piper Cherokee 140 crashed at night, probably when they attempted to avoid a thunderstorm and flew into a hill.

Both of these cases are classic examples of a combination of poor judgment, low experience and overconfidence—a combination practically guaranteed to produce an accident.

Since 1 January eight USAF people have been killed in light aircraft, along with several civilians. It should be emphasized that these fatalities occurred to persons flying non-Aero Club aircraft.

We discussed this subject in the July issue, but apparently it didn't take—at least not with eight of our own who aren't around anymore. Think about that next time you flight plan. You do flight plan, don't you?—Ed. ★

CATCH 22

LT COL THOMAS E. BLEVINS
Directorate of Aerospace Safety



I suppose there is a little truth in all fiction. I recall many laughs while reading the novel CATCH 22. The title of course refers to that one rule in the system which prevents you from getting done what needs to be done.

Recently I encountered a couple of CATCH 22s—one wherein I was encouraged to apply for something that was touted to be good for everyone who participated; yet, when I finally picked up on it, deciding it would be good for me, I suddenly found myself among those listed as an exception to the rule. (CATCH 22.) Next, I was advised that certain information was available to me if only I would write and ask for it. The response to my request was, "The information requested would be releasable if it were available; however, since we no longer retain the information, we are unable to respond to your request."

While I was giving those personal encounters a slow double take, it occurred to me that maybe in the Flight Safety business there are CATCH 22s which go unchallenged. For example, how many problems are attacked by referring them to study; when all that is really needed is a firm decision? How many problems are dismissed by "passing an embellished recommendation to another agency when the action belongs to the unit who has the problem?" How many problems go unresolved because the maintenance folks are relying on Ops, while Ops knows the crew chief is going to give it his best shot?

Other CATCH 22s of note:

Brief all pilots. That's a good item for the flight safety meeting.

Somebody's submitting an 847.

Don't bother with the letdown chart, we'll get a radar vector.

The part failed.

The crew experienced premature gear retraction.

Traffic separation? I always file IFR.

The part failed in fatigue.

This is a common type failure so no action was initiated.

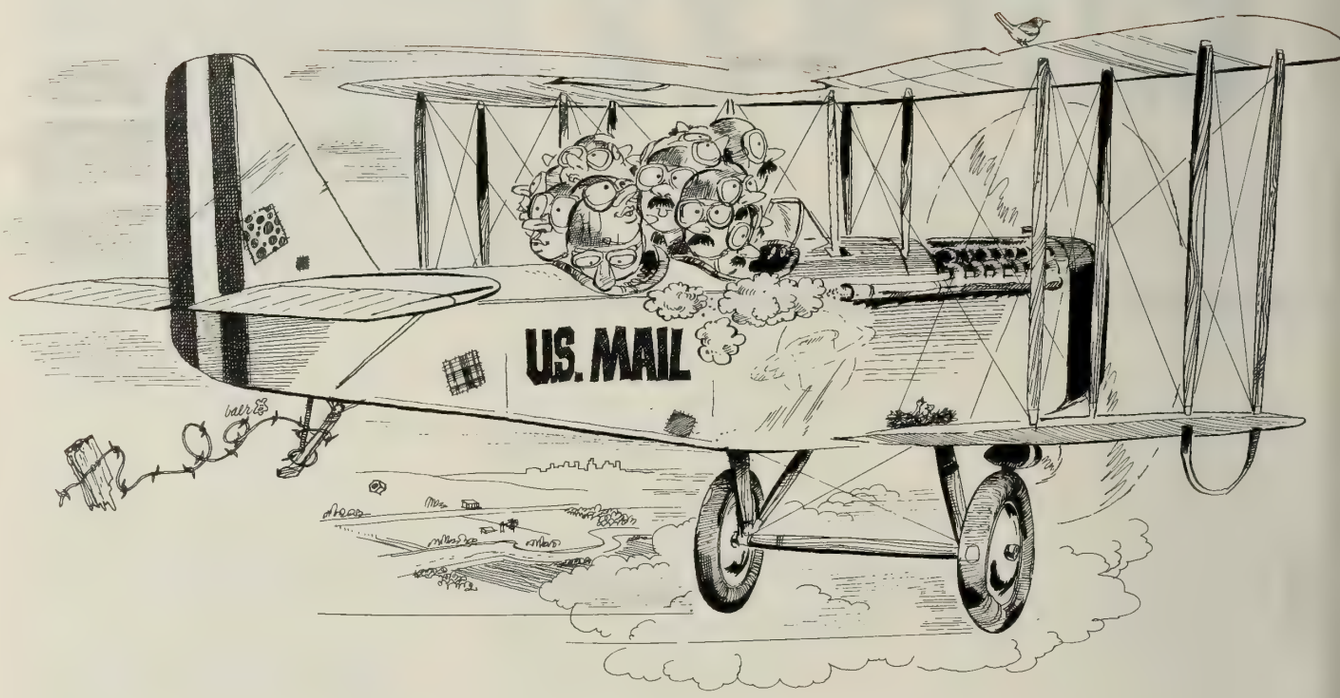
Malfunctions of this type are being experienced worldwide, and are considered to be random type material failures. . . .

But, the classic CATCH 22 I received in a 1972 letter is, "The study conducted by engineering consisted of a quantitative analysis of known methods for solving the problems. The conclusions were based on experience and consultation. Since no new technical information or data resulted from our study, a formal engineering report was not published."

NOTE TO EDITOR: If you have trouble finding the point of this article, please provide concluding paragraph.

MEMO: To asst editor.
Sometimes this guy comes thru with a good article, so let's run this in that hole on page 9, to keep him happy.—Ed. ★

WHATEVER HAPPENED TO VFR?



LT COL J. P. CLINE • Directorate of Aerospace Safety

When Orville and Wilbur started this whole business of flying, the machines were rather simple, as were the demands on the pilot: get the machine in the air, then back on to the ground at a specified location without hitting anything else in the process. To do this he needed to have reasonable coordination and fair eyesight. For some time he based his evaluation of the craft's condition on the sounds of engine and airframe. He determined his location by looking at the ground. This was OK for a while but weather and darkness became unacceptable limiting factors.

The early instruments were designed to help the pilot keep his aircraft right side up when he was denied visual outside references. Needle, ball and air speed flying was a far cry from today's instrument flying but it helped get the mail through.

Each step in the evaluation of new aids—airway lights, radio range, ADF, VOR, TACAN was welcomed as revolutionary. But they were only substitutes for eyeballs and ground references. The attitude gyro was the giant step in the development of instrument flying. But it still holds a back seat to being able to see the real horizon. Today's pilot can take off from point A and land at point B without ever looking outside—if he has to. Unfortunately, some do it that way whether they have to or not!

A pilot trained in years gone by can still remember his instructor harping on the importance of looking around. A student's neck size was supposed to increase during pilot training (or he wasn't looking around). "How many other airplanes can you see?" "What is the name of that town?" "Can we glide to that field from here?" "Clear the area!"

Smoke on the ground told him of landing direction and cross wind problems, as well as which way to perform air work maneuvers so as to not drift out of the area. Commands such as "forced landing!" and "take me home!" required a quick study of the ground below.

The first order of business was learning to fly using visual references. How did he judge his landing? Whether it be a forced landing from miles away or short final, he put his nose on a spot—if the nose covers it up, he'll be long—if the

spot moves away, he'll be short. After a while it became second nature and he called it judgment. He learned clearing techniques such as searching areas, rather than panoramic scanning, and focusing on distant ground points so as to be able to focus on distant aircraft.

Times have changed. As the instruments and NAVAIDs have become more reliable, the pilot has relied more on them. The change has been insidious. He uses the heading indicator instead of section lines for a lazy 8. Center radar advises him when he is drifting out of the working area. Rapcon vectors him into the traffic pattern. VASI helps him land on the runway. Instead of looking for other airplanes, he asks for radar advisories. He executes instrument approaches whether he needs to or not. He is a much better instrument pilot than in previous years, but he considers flying by visual references an emergency back-up procedure.

A lot of our flying is in visual meterological conditions (look out the window and you will notice). A lot of other airplanes operate under visual flight rules. We sometimes need to land at an airfield without NAVAIDs or travel through unfriendly territory that has no NAVAIDs. Sometimes NAVAIDs fail. Sometimes radar controllers make mistakes. Therefore, we still need transparent material through which the pilot can view the outside world. We still need maps other than the kind with blue lines and TACAN frequencies. And we still need pilots who can use the outside reference and old fashioned maps.

It is a sad testimonial to our times when official guidance to pilots includes such self evident statements as, "During VFR radar vectoring—you must continue to look outside." Recent tragic accidents have indicated blind reliance on NAVAIDs or radar controllers in mountainous terrain and inability to cope with VFR landings from other than "canned" entries.

While today's pilot must be able to use all the products of modern technology, he must also maintain proficiency in the fading art of map reading, clearing the area and VFR landing. Our machines have much more capability than the machines of Orville and Wilbur. They are able to do many things and do them under all conditions. We musn't forget, though, that one of those conditions is no NAVAID, no radar VMC. ★



AVOIDING WINTER WEATHER WOES



When winter comes routine maintenance operations become increasingly difficult and extra care is required. This is especially true of the preflight and postflight. Careful attention to potential problems here can pay dividends in time and material saved.

Nature's Number 1 winter booby trap is frostbite. A person working alone can check frostbite by wiggling his hands inside his gloves, making faces or feeling with bare hands for hard or numb areas, or by looking at exposed skin. Mild frostbite thaws quickly and rarely causes damage if it's detected soon and properly cared for. Proper care includes immediate warming. Whenever you are out with two or more people, check each other's ears, cheeks, noses and chins for the tell-tale light yellow-white areas that are the trademarks of frostbite.

Plan your work. You will probably be on the job about three times as long, and need almost twice the equipment. Above all, do the job carefully so it won't have to be done again. It's twice as cold the second time.

The best morale booster for your personnel is the assurance that they are equipped with the best available cold weather clothing—coat, pants, footgear, gloves and face protection. Nothing is more demoralizing than having to work in -30° or lower temperature without the proper clothing. Good leadership and supervision are essential in getting off to a good start when cold weather hits.

The breakdown of equipment is the worst saboteur of morale and efficiency in cold weather maintenance. But it can be overcome with proper care and good protective maintenance year round.

When you have to remove ice, snow or frost from aircraft, there are some precautions you should take. While using the deice spray boom, be sure operators are thoroughly checked out and that they operate the boom with caution. Last winter an operator swung the boom *right* instead of *left* and caused several thousand dollars damage to the vertical stabilizer of an aircraft.

Make sure canopies and doors are closed. Avoid contaminating electrical or electronic components with anti-icing/deicing fluid. Cockpit clean-up of deice fluid is a messy, unpleasant and *avoidable* job.

Don't use too much deicing fluid

around cabin heaters and ventilator air intake ducts. This minimizes the possibility of toxic fumes entering the aircraft cabin or cockpit while taxiing prior to takeoff. Solid streams should not be applied to honeycomb surfaces nor directed into balance bays. Prevent ice and slush from entering control surface balance bays.

On aircraft with a moving stabilizer, deicing personnel should check the applicable maintenance manual because some aircraft require the leading edge to be placed in the UP position to allow drainage of liquids from the surface. Finally, never chip or scrape ice because this might damage aircraft surfaces. A tear in a wing skin panel from a screwdriver blade is hard to explain.

In extremely low temperatures, some door seals become hardened and are subject to cracking on light impact. Therefore, doors should be closed gently so that seal contacts are made without striking.

Some other maintenance tips for aircraft in cold weather operations:

• The wrong type of lubricant or over-lubrication could cause a component to malfunction in extreme cold. When possible, rotate the engine by hand to make sure water or snow hasn't gotten inside and frozen the compressor or turbine wheel.

• Rotate tires to reduce flat spots which could result in damage to the landing gear on takeoff.

• Service aircraft with fuel upon landing, to prevent excessive sweating of fuel tanks and drain fuel sumps after servicing.

• When servicing an aircraft system take special care to prevent moisture from entering. When servicing tires, landing gear struts, and accumulators use ground heat to ensure reseating the valve cores.

• The best time to check tire pressure is when the tire is cool. If tire pressure is adjusted while the tire is hot, it will become underinflated as it cools.

• There are still a few reciprocating engine aircraft around so transient alert personnel should review recip cold weather procedures. In extreme cold weather the power plant and propeller will require preheating with ground heaters. The aircraft should carry technical orders on board with maintenance procedures for extreme cold weather.

• During towing on slippery taxiways, slow down. Control is difficult while turning or stopping. If the parking area is on an incline, the aircraft will tend to push the towing vehicle. While marshaling an aircraft out of or into a parking area, use caution to avoid turning the aircraft too short. The nose gear will tend to slide straight ahead rather than turn.

• While performing an operational check of engines at high or full power, use extreme caution. Even with the brakes set, the aircraft may slide on a snow packed surface or ice. Check that the aircraft is positioned in the runup area so as to prevent the jet blast from throwing ice or snow on other aircraft. Avoid rapid throttle movements. Ice accumulation in a compressor could result in stall.

• Hydraulic leaks may occur in cold weather due to a deforming and contracting of the seals. Before leaking hydraulic units are replaced, if possible, move the aircraft into a heated hangar, or apply external heat to the component or area for approximately an hour. The temperature of the system hydraulic fluid should be increased by operating the hydraulic system. Cycling the system a number of times after a little heat may stop the leak.

• Ensure that nose and main landing gear wheelwells and doors are free of snow and ice that could prevent full retraction of gear or damage components. Check all exposed electrical switches, particularly those on the landing gear, for ice and dirt.

Winter is a difficult time for the maintenance man. It seems that everything conspires to make the job more difficult. But, if we use a little preplanning and then carefully follow TO procedures we can get the job done quickly, safely and right the first time. Then we can go back inside for that hot cup of coffee. ★



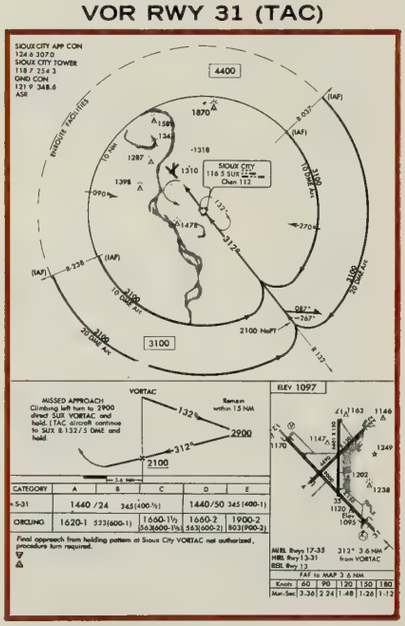
THE IFC APPROACH



This month's article discusses instrument approach procedures that are based on VORTAC facilities. Since the name of the approach refers only to the NAVAID that provides final approach guidance, we will point out some planning factors that should be considered when selecting an approach.

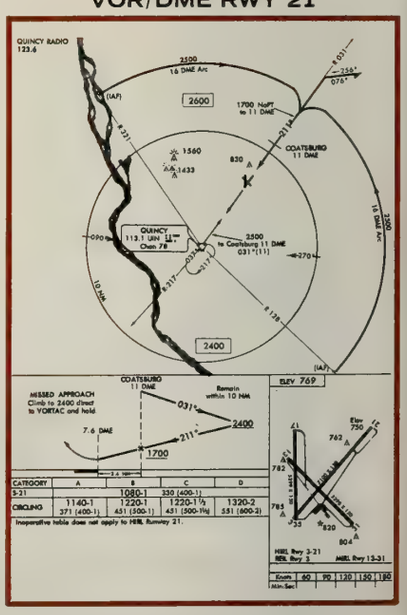
To begin with, a key factor to remember is that while both the VOR and TACAN portions of a VORTAC facility generate radials, they may not be coincidental. Without more specific information, the pilot has no way of knowing if he may fly a VOR approach using TACAN azimuth. With this in mind, let's consider four types of instrument approach procedures based on a VORTAC.

Fig. 1
VOR RWY 31 (TAC)



VOR approaches which have been approved for use by TACAN-only aircraft will be designated by the term (TAC) printed adjacent to the name of the procedure. Approaches identified in this manner are usually civil procedures adopted for DOD use. VOR-only aircraft flying the approach will use the VOR facility as the IAF, while pilots of TACAN-only aircraft are expected to file for an IAF indicated by a radial/DME fix. The procedure may be flown using either VOR or TACAN azimuth. Note that in the example, the final approach fix (FAF) is the VORTAC itself. Although TACAN approach design requires radial/DME fixes for holding and IAF purposes, it is acceptable to designate the TACAN as the FAF. Note also that the missed approach instructions address both VOR and TACAN procedures. Not all approaches provide missed approach procedures based on both NAVAIDS so it pays to study the approach thoroughly. If the missed approach instructions are not compatible with your aircraft's equipment, coordinate alternate procedures with air traffic control prior to flying the approach.

Fig. 2
VOR/DME RWY 21



The VOR/DME approach procedure is commonly used by civil aircraft. A pilot flying an aircraft equipped with TACAN as the only

NAVAID cannot fly the approach safely since it only specifies VOR azimuth. As the name implies, DME is required for some portions of the final approach and a VOR-only aircraft will be unable to fly it. In this example the procedure turn fix is Coatsburg intersection, *not* the VOR.

A VORTAC approach may be flown using either VOR or TACAN azimuth. Frequently, a VORTAC approach may be flown without DME. Compare the two approaches in Figures 3 and 4. The approach to Craig AFB requires DME but may be flown using VOR azimuth. The Amarillo approach does not require DME but provides the information for use by TACAN-equipped aircraft. Note that the Amarillo approach also displays both VOR and TACAN holding patterns and offers two ways (timing and DME) to determine the missed approach point. Note also that the feeder facilities to Amarillo provide guidance to the VOR and not to the TACAN IAF.

Remember that the name of an approach refers only to the NAVAID providing final approach guidance. At times, the approach segments prior to final will be based on VORTAC radials but the procedure name will not specify VOR or TACAN. In these cases, look first at the holding pattern. A holding pattern directly over a VORTAC can be used only by VOR-equipped aircraft. TACAN holding design requires a radial/DME fix because the large cone of confusion overhead a TACAN facility. The approach in Figure 5 provides an arrival holding pattern suitable for TACAN-only aircraft but no holding pattern for a VOR-only aircraft. Additionally, it allows the pilot to determine the step-down fixes and the final approach fix with DME or with crossing radials.

In summary, if you are TACAN-only, don't plan to fly the approach unless you see the term (TAC), TACAN, or VORTAC mentioned; or, as in Figure 5, TACAN procedures are provided. If you plan to fly an approach with VOR, look for the term "VOR" or "VORTAC" in the approach name and study the approach to see if DME is required prior to the final. For an approach like the one in Figure 5, look for VOR procedures on the plan and profile views. ★

Fig. 3
HI-VORTAC RWY 14L

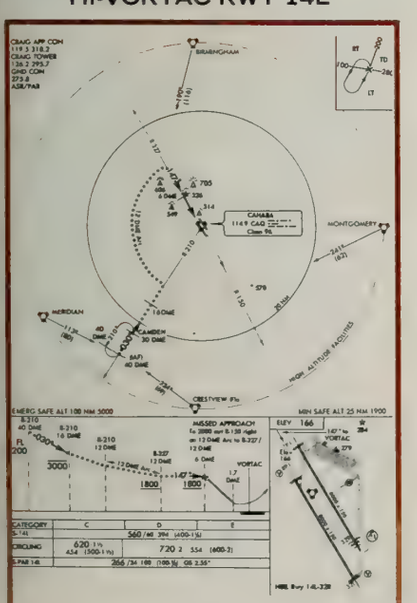


Fig. 4
HI-VORTAC RWY 21

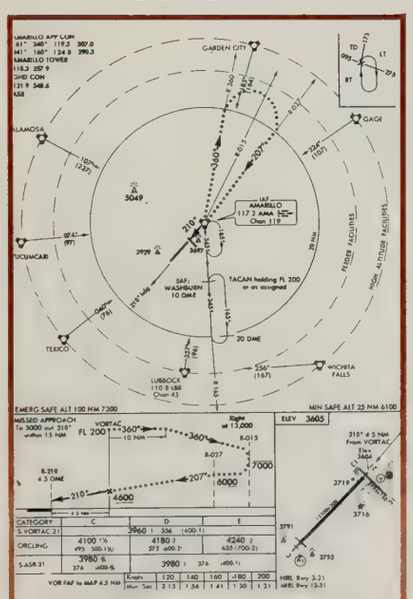
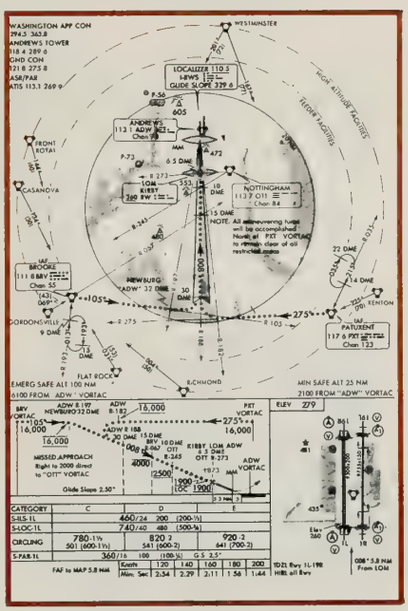


Fig. 5
HI-ILS RWY IL



HE WAITED TOO LONG

SSGT THOMAS D. MacDONALD
32 TFS APO NY

Sgt Joe Kincad walked leisurely to his airplane. It was the fourth day of the ORI and Joe was starting to feel the strain of max flying and twelve hour shifts. As he rounded the corner of the bunker that housed his F-4E, he saw armament hanging from the pylons ready for the day's first flight. For the last three days Joe's phantom had flown 12 OR flights in a row. There's a lot of my sweat in that airplane, Joe thought quietly to himself. He was proud to be a crew chief and the aircraft displayed his devotion.

During his morning preflight inspection the flightline expediter drove to Joe's bunker and asked if he was having any problems. "No," Joe replied, wiping his hands with a rag, "but I could use some PD680. The belly's dirty from all those cart starts and I want to wipe it down. Ycu know pilots are touchy during an evaluation. Sometimes they think a dirty airplane means problems." The expediter, a TSgt, had a lot of things to do beside worrying about dirty airplanes, but he also knew

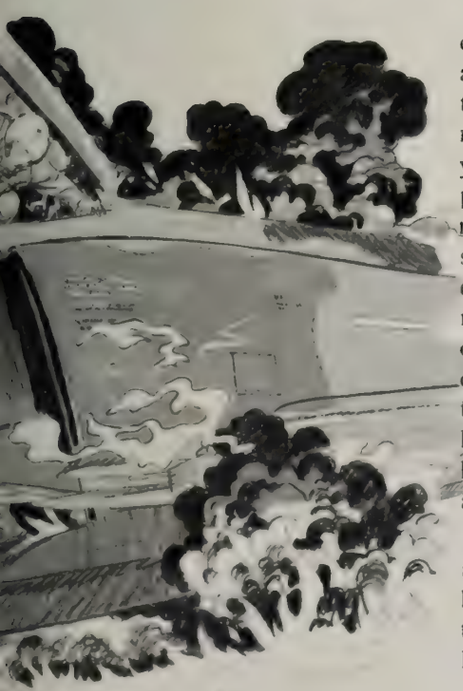


what type of crew chief Joe was. "O.K. Joe," he said, "As soon as I get a chance I'll bring you some. In the meantime finish your preflight, take your forms to the flight shack and grab some coffee. Today is the last flying day and there's no telling what will happen, so you might as well relax while you can."

He drove away and Joe walked back into the bunker, closed his tool box, picked up the aircraft forms and walked to the flight shack. Once inside he picked up a tech order on starter carts, the -2-8. Yesterday his airplane had two hang fires and he wanted to read up on starting precautions. Fires scared Joe, especially with a fully loaded airplane.

Fifteen minutes later the expediter came into the crew chief lounge and said all the aircrews were on the way out. Joe hurried to the bunker because he didn't like the aircrew arriving without him being there, and he didn't want to start the day with a bad impression.

Once back at his bunker Joe saw the bucket of cleaning fluid, so hurriedly he scrubbed the belly. As he was pulling the downlocks off,



the aircrew arrived. "How's the bird, Chief," the pilot asked as he was climbing the aircraft ladder. "No write-ups in twelve flights, sir," Joe said proudly.

With the downlocks off and the pins pulled, the aircrew walked around the airplane then climbed in the cockpits for a hot preflight. After all the flight control checks were completed, the pilot told Joe to button it up before engine shutdown in case they got the word to scramble.

Joe was putting up the last panel when he saw a fuel leak along the center fuselage. Man, I can't break this thing now, Joe was thinking, when the pilot said, "We're shutting her down, chief, and going on alert." Joe acknowledged and once again the bunker was quiet.

Joe walked over to the two white cans that contained carts and proceeded to remove the lids. Once opened, he carried them under the airplane and pulled out the breeches. Step by step, according to the TO, Joe installed the carts then looked at the fuel leak again. "Damn," he said quietly to himself, and closed the panels, hoping it wouldn't get any worse.

The flightline was very still for over an hour. Joe sat talking to his aircrew about anything and everything. They were all trying to remain calm but it wasn't easy when you might scramble at any time. The pilot mentioned something to the navigator about yesterday's bombing scores but Joe wasn't listening. His eyes were fixed on the ground beneath the airplane where a puddle of fuel had formed. Joe knew someone had to be told. He walked over to the pilot and said, "Captain, I'd like you to take a look at" . . . but he was cut off by the scramble horn and flashing green "Go" light.

The aircrew ran up the ladder and jumped in the cockpits. Joe helped strap in the back seater, then the pilot. He climbed down the ladder and pulled it away from the aircraft while giving the AC the signal to start number two.

A loud noise of air gushing, then black smoke filled the bunker. Joe took a few steps back, caught his breath, then bent down to get a clear view of his aircraft. When number two engine was up to rpm, number one was started.

Again there was a strong air gushing noise that Joe could hear over his headset and one engine running. But this time a long orange and red flame accompanied the smoke. Number one engine had torched. Joe knew that this was no problem—it happens. Then the bunker floor lit up like a grass fire that spread to the belly of the F-4. Joe could not believe what he was seeing. The fire quickly moved to both wheel wells. That fuel leak Joe hesitated to mention was a ruptured fuel cell, a time bomb waiting to ignite.

The pilot looked down at his crew chief whose eyes were fixed on the airplane. Then Joe looked up and gave the aircrew a signal to cut engines and get out. The aircrew members could not understand what was happening. Then both fire lights came on and the trained minds of the pilots went into action. The engines were killed and the proper egress initiated. Joe grabbed the fire bottle as the crew ran for help. But nothing could be done as the aircraft became engulfed in flames. The crew chief knew his battle was lost and turned to escape. But Joe had waited too long. As he turned, the right drop tank exploded. All that could be seen was a big fire ball in the bunker.

The fire department arrived in very short time but the armament started to go off and nothing could be done except contain the fire until it burned itself out.

Many theories were given as to the cause of a fire that killed one man and destroyed an aircraft. But the truth lies with a man who can never tell it. *He waited too long.* ★

OPS TOPICS

LOOK OUT



In a five day period there were eight near misses reported to the Safety Center. In every case, the incident occurred either in the traffic pattern or on an instrument approach or departure within 5 miles of the field. The aircraft involved included all types from DC-8's and Cessna 150's to F-4's and C-141's. We don't want any midairs. Keep on clearing!

HOT, HEAVY, HELP!



The student pilot landed his trusty Talon at a southern base on an out and back. The landing was not bad but the student was not used to the high altitude/temperature or the weight of his aircraft (he landed with over 2200 lbs of fuel on board). As a result, he failed to use proper aerobraking or wheel braking and used up 10,000 feet of runway before he took the barrier. He did do one thing right, however. He first tried to clear the runway onto a taxiway but decided not to due to his high speed—50 knots plus.

WATER IN THE FUEL



Investigation of a sister service crash indicates that an engine failure was caused by large quantities of water in the fuel. At present the source of contamination is unknown.

JACK FOD

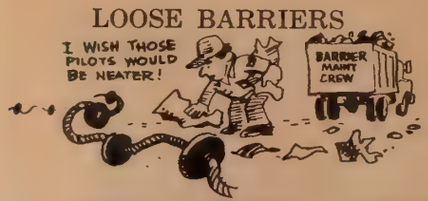
Immediately after the F-4 touched down, the RSU observers saw sparks coming from the right engine. Damage to the engine resulted from ingestion of the nose gear jack pad latch assembly. The latch came loose as a result of cotter pin failure. This latch might be something worth checking on preflight.

OVER-G AGAIN



An F-4, with an instructor in the rear seat, was engaged in an ACM training sortie. While the aircraft was diving for energy to reestablish an attack, the instructor observed a master caution light. When he challenged the pilot for the reason, the pilot replied that he didn't have a master caution or any warning lights on. At 560 knots (below 12M feet) the instructor called for a pull out. The student AC interpreted this to mean that he had sufficient energy to reengage. So he applied aft stick and came out of AB. The instructor interpreted the lack of rotation of the aircraft and the rapidly unwinding altimeter as a possible control problem. So he pulled the throttles to idle and grasped the stick to help the pilot recover from the dive. At this point the aircraft "dug in" and sustained a major over-g causing considerable damage.

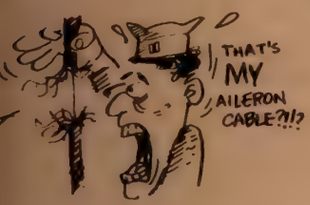
LOOSE BARRIERS



After the C-130 landed, the crew found the UHF antenna missing and some damage to the aircraft skin. At about the time the C-130 damage was discovered a BAK-13 barrier maintenance crew checking on a loose barrier cable found two C-130 and one C-141 UHF antennas near the barrier. The antennas had been broken by contact with the loose cable.

OPS TOPICS

FRAYED CABLES



During a home station check after flight, the maintenance crew heard a rasping noise in the left wheel well of the T-39. When they investigated they found that the upper left aileron cable was frayed through four of the six strands and the other two strands showed varying degrees of wear. The other base aircraft were inspected and three additional cables were found frayed; all cables were frayed where they passed through a pulley.

SURPRISE

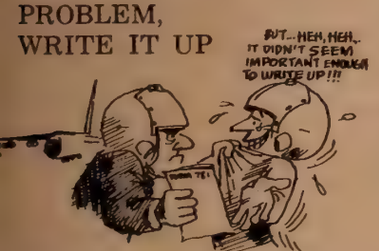


The upgrade pilot was in the back seat of the T-38. While waiting Nr 1 for takeoff he attempted to adjust the rudder pedals. Unfortunately, instead of the pedal release he pulled the canopy jettison T-handle. He has since received additional training in switch positions and functions.

FUEL FLOW DIFFERENTIAL

Shortly after takeoff the O-2 pilot noticed that the front engine fuel flow was lower than the rear and that the two fuel tanks also showed a large differential. The pilot immediately suspected a fuel leak even though he had not observed fuel flow indications at level off and had no "base line" fuel flow reference. After landing, maintenance found no evidence of a fuel leak but did find that there was a difference of 3 gal/hr fuel flow between the two engines at identical power settings.

IF YOU HAVE A PROBLEM, WRITE IT UP

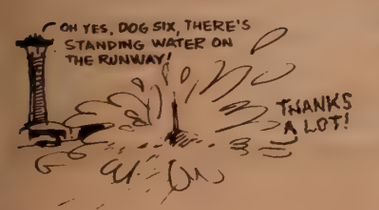


The B-52 was involved in a brute force disconnect on a refueling mission. The KC-135's boom nozzle was damaged. However, since the bomber's system was thought to be OK no write up was made. On the next flight the bomber at first could not get a disconnect. The crew finally did accomplish the disconnect and after landing maintenance found a broken signal wire in the air refueling release system. Wonder if the wire was broken before the first incident.

BARRIERS BARRIERS BARRIERS

The barrier monster is biting airplanes again. This time it got a T-33 and a T-39. If you don't use a barrier for your airplane, you usually are not very familiar with the barrier characteristics. However, a little study might save you from an embarrassing incident like being towed to the ramp minus a speed brake.

LIQUID FOD



A formation of T-38s was on takeoff roll when Lead passed through a large puddle of water. Both aircrews heard a loud bang, and Nr 2 saw flames shoot out of Lead's AB section. After the abort was complete, maintenance found extensive foreign object damage in both engines on Lead's aircraft from water ingestion. The flight crews were unaware of water on the runway. They were not briefed by base ops nor tower, and the angle of the sun plus a depression in the runway did not allow them to see the water until too late.

HISTORIC HOLOCAUST

Mr. HY BOSCH
Directorate of Aerospace Safety



"TAKE A LESSON FROM HISTORY"

How often have you heard the phrase "History repeats itself?" We all know, too well, that the repeat precept is valid; especially when people fail to heed lessons learned through experience. Here's a classic example that points up the need for establishing and enforcing strict explosives safety quantity-distance criteria and standards.

Early in the 1870s, an explosives storage area was built on two acres of meadow bordering on the Concord River in Massachusetts. It was an ideal location at the time. But time passed and a land company bought property adjoining the storage area, laid out streets and lots, auctioned off land parcels, and started building houses. No explosions had occurred in the 29 years the storage area had been in business, and the growing citizenry of Tewsbury considered it harmless.

Perhaps it was safe . . . in the beginning. The 233 feet that separated the two magazines was probably sufficient for the initial amount of stored explosives. BUT, 29 years later, one magazine held 20,275 pounds of high explosives, and the other some 27,500 pounds.

Today, a minimum of 340 feet is required between these quantities of explosives. This distanace helps prevent an accidental explosion in one magazine from simultaneously detonating the explosives in the second magazine.

Houses were built as close as 78 feet from the magazines. *Today, clear zones are required around all military explosives areas to prevent building such unrelated facilities within the high hazard area.* Since the magazines were so close together they should have been considered as one storage location containing 47,775 pounds of explosives. The clear zone, free of inhabited buildings, would have been 1,475 feet.

Our story now zeros in on 6 July 1903, when a storage area employee reported that nitroglycerin had exuded from dynamite stored in one of the magazines, leaving a highly sensitive explosives residue on the floor. *Today, tech orders require nitroglycerin-base dynamite to be turned monthly in storage to prevent such exudation. And storage areas must be inspected regularly to prevent potentially hazardous situations from getting out of hand.*

The storage site people decided to move out the explosives, clean up the residue, and remove and replace the wooden floor. They loaded two wagons but left them parked between the two building . . . eliminating the little separation distance that did exist. The carpenters came to remove the floor, so the foreman decided to have the explosive residue cleaned up. He had been told to sweep up the sand, dirt, and sawdust, and use a solution of carbonate of soda to make it easier to get rid of the exuded nitroglycerin. But the carpenters were in a hurry, so the foreman skipped the sweep-down and poured some kind of liquid onto the contaminated floor. History doesn't say what solution he used, but you can bet it wasn't the right one.

Seconds later, smoke began to rise from the floor. Water poured on the smouldering fire didn't put it out . . . and the magazine blew. The two loaded wagons and the other magazine went up in a chain reaction. Seven workers and a dozen people living in the nearby houses were killed, and more than 50 others injured. Houses as far away as 1,650 feet were badly damaged.

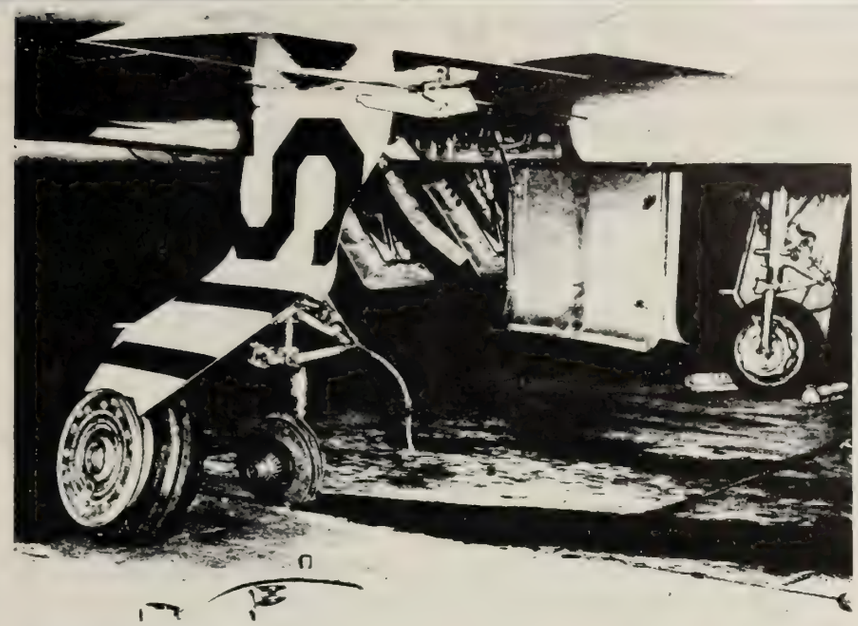
Perhaps it wouldn't have happened if the foreman had followed directions. Or maybe only the one magazine would've blown, if the two wagonloads of explosives hadn't been parked between the buildings. We'll never know. But we do know they had too much explosives material in the magazines to begin with; had too many people in the hazard area; shouldn't have parked the wagons between the magazines; failed to follow instructions; had no fire protection; and lacked proper supervision. Makes you wonder how they got by for 29 years, doesn't it?

If we know enough to develop sophisticated explosives, we are surely capable of controlling them. Education, pre-planning, supervision, and written technical procedures—all these tools are right at hand, so make use of them.

Take a lesson from history, rather than letting history repeat itself. ★

AIR OR NITROGEN

TIRE INFLATION



Adapted from F-5 Technical Digest August 1975

Earlier this year a USAF heavyweight high-speed takeoff was aborted; although the drag chute failed to deploy, the pilot succeeded in stopping the tactical fighter safely by the use of heavy wheel braking. Upon clearing the runway, the aircraft stopped to allow the damaged tires and wheel brakes to cool. The engines were kept running until a fire extinguisher was positioned as a precaution against the possibility that the hot wheel brakes might ignite draining fuel or fuel fumes. About 10 minutes later a fuse plug blew on one wheel, followed shortly by a blowout and autoignition of the opposite main tire. The blowout or explosion produced a bright flame. Incidentally, similar occurrences were experienced by 727 and DC-9 commercial airliners which blew the main wheels off their axles. A post flight investigation revealed hydrocarbon residue and confirmed that autoignition and burning had occurred.

In addition, the Flight Safety Foundation Inc. reported the crash of a Caravelle airliner caused by the main landing gear tires exploding in the wheel well following an extensive taxiing distance and takeoff. A 727 airliner operating under identical conditions experienced a tire explosion following takeoff. The 727 was severely damaged but made a safe emergency landing. In each of these cases, a postflight investigation revealed hydrocarbon residue and confirmed that autoignition and burning had occurred inside the tire, resulting in an explosion.

The British Aircraft Corporation and the Goodyear Tire and Rubber Company investigated similar tire explosions and duplicated the conditions that produced tire explosions. Each determined that the solvents in the tire rubber are converted into gas at temperatures in excess of 204°C (400°F). When the solvent gas combines with the compressed air in the tire and reaches a combustible fuel-air ratio mixture, the hot gas mixture of hydrocarbons and oxygen would ignite automatically. The autoignition combination requires an oxygen content of only 10 percent or more and an autoignition temperature. It is interesting to note that heat alone is insufficient to blow out a tire by increased air pressure. Exposing a tire pressurized to 140 psi to a temperature of 260°C would increase the tire pressure by only about 20 psi. Incidentally, an aircraft tire will begin to deteriorate at 190°C if held at this temperature for any length of time. You should keep in mind that this is 25°C below the F-5 wheel fuse plug melting point.

The Goodyear Tire and Rubber Company indicated that the air pressure required to rupture or fail the tire bead would be in excess of 900 psi. The British Evaluation Test indicated the force of the explosion to be far in excess of this bead rupturing pressure. If you are still in doubt that this internal high air pressure force could blow a wheel off the axle, please note the photo shown above.

In this accident, the low-pressure air chuck had been accidentally attached to the high pressure air hose. The air chuck was connected to the T-38A main landing gear tire and the low air pressure gage was set at 185 psi. Failing to obtain any air pressure from the low pressure regulator, the technician opened the high pressure valve. This resulted in the tire and wheel being blown from the axle. Disintegrating parts severely damaged the main landing gear door, brake assembly, and strut door. Nearly 30 man hours were required to replace the damaged parts.

For the past 65 years it has been traditional to service aircraft tires with compressed air. However, there is now evidence that the use of compressed air to inflate the main landing gear tires may contribute to tire explosions following extensive taxi operation, dragging wheel brakes, or high speed aborted takeoff. Under these circumstances, the use of nitrogen would be preferable. A number of commercial jet airline operators are now servicing their aircraft tires with nitrogen. Nitrogen will not burn, it is less corrosive on the metal parts of the wheel, and it reduces oxidation of the inner tire walls. ★

TECH TOPICS

improper hardware

While the pilot was taxiing the T-39 he discovered the rudder binding at full rudder travel. The aircraft was returned to the parking area, where it was found that a bolt that had been used to attach bonding wire to the upper rudder support had worn a hole through the rudder surface. The bolt caught on the edge of the hole. The item manager was contacted for proper hardware to be used for attaching bonding wire. The proper hardware was a rivet.

KC-135 incident

During a refueling training mission, the pilot of a KC-135 observed nr 4 engine oil pressure fluctuating. The receiver checked the exterior of the engine and told the pilot it was covered with oil. The engine was shut down. Inspection after landing found the oil transfer tubes damaged. The front accessory case had been removed prior to this flight to replace a cracked inlet guide vane assembly. When the front accessory case was reinstalled, the oil transfer tubes were damaged.

missing cover

The KC-135 pilot was making a taxiback landing when the SOF called him stating the HF antenna coupler fairing was missing from the vertical stabilizer. Post flight investigation revealed that 33 screws were missing on the left side. The remaining screws were still intact. The 33 missing screws had not been documented in 781 forms as being incomplete.

sump draining



During a training mission the KC-135 flight crew detected nr 4 main fuel tank was depleting faster than normal and ahead of nr 1 tank. The receiver advised the tanker crew that fuel was streaming from nr 4 engine cowling. Inspection after landing found the drain plug out of the main fuel strainer laying in the cowling. Maintenance had been performed on the engine prior to flight. The safety wire was broken, allowing the drain plug to come loose and fall out during flight.

pins

During takeoff, the pilot of a T-38 noticed that aft stick force was unusually light and at lift-off the nose over-rotated. Forward stick movement was initiated; however, there was no resistance to the forward stick inputs. Aft stick movement was extremely difficult; forces were heavy and the control stick seemed to bind. After an emergency landing, investigation revealed that the pitch trim actuator had been replaced. The cause of the trim problem was that the two cotter pins which retained the nuts to the fore and aft attach bolts were missing. The nuts had worked loose from aircraft vibration, the aft nut completely off, allowing the attachment bolt to come out and let the trim actuator drop down and wedge against the airframe.

short warning



At 1620 a C-141 was wind damaged when a thunderstorm moving toward the base blew across part of the main ramp. A weather warning was issued at 1504 which forecast winds of 20 knots with gusts to 40, valid from 1700 until 1900. A second weather warning was issued at 1618 just two minutes before the maximum wind occurred. When you receive a weather warning, always check equipment to make sure it is secure or tied down. If you maintenance people working on the flightline think the storm looks worse than the forecast predicts, ask job control for an update.

short on air

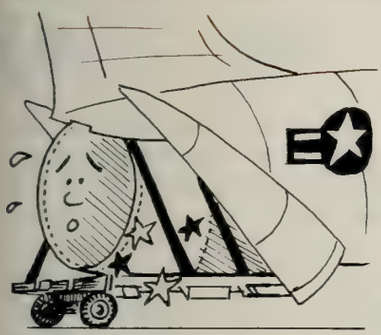
A pilot was ferrying an RF-101 from a contract maintenance facility. The aircraft had accelerated through 140 kias when the airspeed indicator began reading erratically, ranging from 250 knots to 110 knots. Since it was too late to abort, the takeoff was continued. Another F-101 was departing two minutes later so the pilot elected to join on that pilot's wing. He flew in that position to the ferry base. During descent the RF-101 pilot noticed that the pitch boundary indicator was erroneous. Investigation at the ferry base found that the contract maintenance facility had crimped the pitot pressure hose between the hinged nose frame and forward frame, causing improper pitot air supply.

the dump

Right after climbout the scanner noticed fuel venting from the right wing of a C-141. The boost pumps for the right extended range tank were turned off and fuel venting ceased. An emergency was declared. Troubleshooting after landing discovered the fuel jettison switch loose in its mount and twisted, which allowed one of the connecting wires to loosen and intermittently short, causing the system to dump.



over sized engine



The C-141 was being unloaded and as the palletized canned engine was rolled onto the K-loader, the K-loader bed settled to one side causing the engine can top to strike a pressure door lock and pull the lock storage bracket rivets from the mounts. Unloading personnel failed to check for adequate clearance between cargo and aircraft pressure door lock overhead.

keep it greased



After electrical and manual stabilizer trim were lost on a B-52, inspection found the stabilizer jackscrew heavily coated with rust which caused it to bind. During initial takeoff, another B-52 pilot noticed the stabilizer trim system was slow in the nose down direction. Maintenance corrected the problem by lubricating the jackscrew and traveling nut.

The pilot of a CH-3E heard a loud bang from nr 2 engine accompanied by moderate aircraft shudder. Cause was lack of lubrication on the inlet guide vane actuating rings.

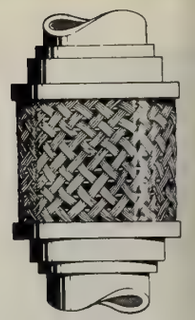
No aircraft will go forever without attention. Unfortunately, it cannot cry out and warn the mechanic—or can it? At times it makes unusual noises, or it vibrates—indications of distress.

There is absolutely no justifiable reason for an aircraft accident resulting from lack of lubrication. Nor should aircrews be subjected to problems like those related above.

lack of communication

The munitions loading crew was dispatched to remove impulse cartridges from all stations on an A-7 aircraft. Later that day another crew was dispatched to down load an empty LAU-68 rocket launcher. The crew chief and another maintenance man down loaded the launcher and put it in the line delivery truck. While the crew chief was loading the launcher, another team member started turning the cart liners around and screwing them into the breech for sealing. When the crew chief returned he saw that the cart liners were screwed into the breech on station 1. Assuming all cart liners had been turned around and screwed in, he installed safety wire and seal. When all station sealing was completed, the crew chief departed. The following day a third munitions load crew was dispatched to up load a TER and six BDU-33 practice bombs on station nr 2. A check of all aircraft station and the 781 showed the aircraft to be de-carted. The crew removed the breeches from the station they were going to load, station nr 2, and started functional check. While performing the salvo jettison switch press and hold, two ARD 863-1 impulse cartridges were fired in station nr 1. When tech data is disregarded, it can lead to operational failure and even to serious accidents resulting in loss of life, property, equipment and mission capability. ★

HAROLD POEHLMANN
Fairchild Republic Co
Directorate of Aerospace Safety



A NEW BREED OF CAT

This article from the August 1970 AEROSPACE SAFETY is recommended reading for aircraft maintenance personnel whose work involves aircraft fuel systems. The article is reprinted here as the result of a major aircraft accident caused by failure of the main fuel manifold line bellows—Ed.

Flexible bellows, long used in missile and spacecraft, have been put to widespread use in aircraft. They are frequently seen in jet engine compressor bleed air and fuel supply systems.

Aircraft system designers have found these flexible units particularly suitable because of their ability to absorb thermal expansion and contraction, their installation flexibility and ease of alignment during routine maintenance, and ability to handle both high and low temperatures.

Fine, you say, this looks like real good equipment. Right, but to keep it good we must protect it from damage. This abuse can take the form of dents, cuts, nicks, chafing, improper installation causing out-of-limits stretch or bend and any other wounds that "normal" maintenance can inflict. A dent caused by dropping a heavy tool on the corrugations is certain to produce a condition that can lead to rapid fatigue failure. Plumbing, cables or, in particular, a steel braid covered flex line that remains in contact with the bellows will literally "eat" through the thin bellows material in a time period commensurate with the vibration that is present and the contact pressure.

You probably have noticed that some flex ducts are covered with stainless steel braid, some have a heavy rubber cover shield, some possess internal reinforcement or stretch limiting struts. Regardless of construction, all react the same to external damage. You would be amazed as to what happens when a low pressure fuel duct bellows develops a crack. The fuel escapes in a spectacular atomized spray, usually resulting in a 4th of July fireworks display. The cracking of a hot air duct produces equally serious inflight problems.

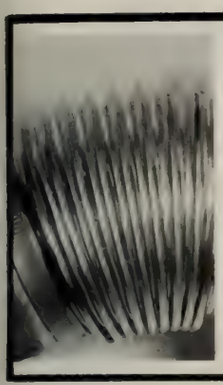
Someone from the back of the room has asked, "What can we do to prevent this?" Good question, we were just coming to this. The intent of this humble essay is to bring primarily two things to the attention of crew chiefs and mechanics: (1) that the service life of bellows ducting units can be shortened if they are allowed to remain in service with damage, and (2) the necessity of knowing where to locate the allowable damage criteria.

Tragic accidents are certain to develop from duct failure, whether they are conducting fuel, hot air or cryogenics. Reality indicates that maintenance mistakes will be with us till the end of time, but you must be capable of identifying a bellows that shows evidence of damage and detecting a bellows that is grossly out of alignment. You must also be diligent in locating and adhering to the appropriate damage allowance instructions. These usually can be found in the Structural Repair & Limits Manual Dash 3 Series for your aircraft or the Dash 6 Series in the case of engines.

My experience has been that there is a general lack of awareness as to what kind and degree of damage is tolerable on flex bellows. The basic design philosophy that can form a section of metal into a highly flexible unit with extraordinary service life is also very unforgiving when the hardware is subjected to damage. When in doubt call your inspection section for their "eagle eye" assistance.

Displayed here are some photos of typical damage along with some sample damage limits. These happen to be in connection with bleed air ducts. Notice the four general classifications: flattened areas, knife edge dents, lateral dents and smooth contour dents. We also draw your attention to the fact that trough or inner convolution damage are "no-nos" and ". . . no dents, no damage, no nuttin'."

When working in an area of flex ducts, temporarily cover or protect them against wrench slippage or



Bellows being subjected to a bend beyond its allowable design limits, possibly the internal restraint strut device is broken.



Example of a .4 steel braided flex line not having proper clearance from the bellows.

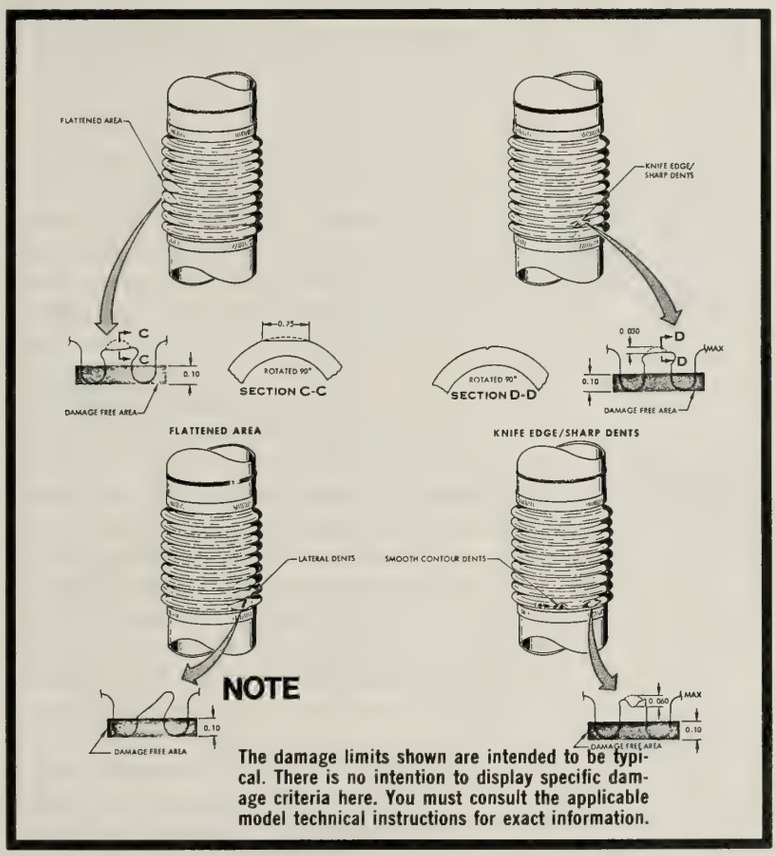


Material for the salvage yard.

fulcrum action. Do not pry against or stand on any units that might be in a vulnerable position in the lower engine compartment, such as a main engine fuel supply line. Make certain the line assembly is supported and not allowed to stretch a bellows, as when one end is disconnected from the engine. When installing a flex duct unit that has a swivel attachment, insure that the assembly is in proper alignment with all bellows in their normal design contours before securing the swivel connection.

Be suspicious of any bellows joint connection that has flanges that require abnormal gaps, compression or misalignment. This is usually a signal of improper design or installation, or bend damage. Subjecting a bellows to this deformation and stress is "bad news." If a bellows line is in jeopardy of becoming caught or jammed against an engine or airframe during engine removal, either secure it or remove the assembly to prevent damage.

The main object is to be aware of the stringent damage limits, where the data can be located and the need to give these "cats" a thorough 360 degree inspection after any unscheduled maintenance actions in addition to the routine inspection periods. Don't you be the one who played a part in causing high cost "4th of July fireworks out of season." ★



The damage limits shown are intended to be typical. There is no intention to display specific damage criteria here. You must consult the applicable model technical instructions for exact information.



The appearance of the collapsed lower bellows and stretched upper unit could be a clue that the assembly is not installed correctly.

Dearmed And DANGEROUS

MR. GORDON S. TAYLOR
Directorate of Aerospace Safety

What does the term "dearmed" mean to you? Let's say that an aircraft ejection seat on a stand in the egress shop has been dearmed, or an aircraft on the flight line has been dearmed. Would you consider the seat and the aircraft safe from explosions, detonations, and functioning of explosives devices?

Look what happened during a simple and reasonably controlled training class:

In accordance with higher headquarters directions, egress familiarization training was being conducted by qualified egress personnel in the egress shop. It was a small, easily managed group of four students, two of which were old-timer master sergeants. A well prepared and proven plan of instruction was being followed, step-by-step. What could be safer?

During the instruction, the students were taken into the hangar for practical observation of the aircraft and its egress system. After completion of this portion of the training, the class returned to the egress shop for further instructions.

As interested students should and will do, they expressed concern over accidental firing of egress items. The question was asked, "What would happen if the hand grips were partially raised?" The instructor explained that accidental movement of the hand grips, even with the trigger depressed, would not actuate the ejection sequence, unless the linkage traveled the full distance of the slot. Partial movement was demonstrated by the instructor. The question was then asked as to how high the handle could be raised before the linkage traveled far enough to cause functioning. To this, the instructor replied that he could not show them on this seat, but to leave everything alone and he would show them by use of the tech order.

While the instructor was across the room looking in the tech order file, the students continued to discuss the system and the raising of the handles. One of the old-timer students, assuming the seat was inert, removed the flight status pin, partially raised the hand grip, and squeezed the trigger as he had seen the instructor do. However, he extended the hand grip to the distance necessary to fire the initiator. Surprise! The seat being used for training was not inert, nor were the initiators safetied. Zap goes an M26 and an M27 initiator and poof goes the pride of the instructor as well as the students.

The self-confidence of the instructor was badly wounded also. During the course of the class, he had stressed several times to the students "not to touch anything yellow, yellow and black, or red because it must be assumed that it is connected to a live system." In spite of these warnings, the students assumed the seat being used for demonstration was inert because the instructor had not specifically stated that this particular seat also contained explosives items. The students thought his warnings pertained to installed seats only.

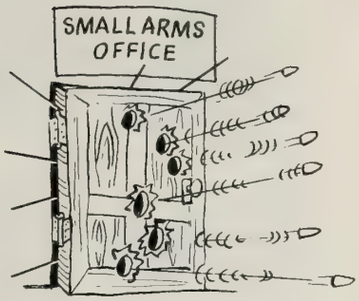
During the course of the investigation, it became evident that a large number of personnel misunderstood the term "disarmed." Approximately 40 maintenance personnel questioned were of the opinion that when an aircraft, or seat, was dearmed, it was completely safe and that nothing could be fired. A number of people questioned did not realize, for example, that the canopy on an aircraft could still be fired even though the seat had been removed.

This mishap, even though it was only an incident because of the relatively low cost of loss incurred, was effectively investigated and well reported. It has pointed out that misunderstanding and assumption were again the cause of a mishap and highlighted the potential for many more such mishaps because of the false security created by the terms "disarmed or dearmed." Written documents and training programs must be carefully prepared; supervisors and safety officers must be alert for these misnomers and counteract them with factual and clear guidance. ★



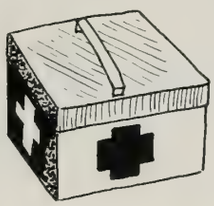
SMALL ARMS—BIG PROBLEM

For some unexplained reason we are having a rash of unintentional firings of small arms. We have shot up floors, walls, ceilings and clearing barrels, almost everything except, fortunately, people. During June 1975 alone there were six inadvertent bangs from M16 rifles and 12 gauge shotguns. A total of 18 such events in the first six months of 1975 involved three 12 gauge shotguns, five .38 cal revolvers, and 10 5.56mm M16 rifles. Obviously, weapons handling and supervision need to be reemphasized.



FIRST AID TRAINING

One of the problems associated with the dispersed nature of the ICBM sites is the inability to quickly administer medical attention in case of an injury on site. Normally, a hospital or medical attention is hours away. The remoteness, plus the fact that an ICBM facility has many hazards, creates a need for first aid knowledge. In order to gain or retain this knowledge, the ICBM training program should include first aid instruction for ICBM personnel who are dispatched. Prompt and proper first aid could save a life.



THAT LIFE SAVING DEVICE WILL BE THE DEATH OF YOU YET

Aircrew escape and survival system devices, more commonly called egress items, are fired far more often unintentionally than they are intentionally. Many times the results are more embarrassing than costly, but occasionally they turn out to be deadly. The first six months of 1975 have produced 37, count 'em—37, explosives mishaps involving egress items. We continue to fire Koch survival kit actuators because the mode selector switch is left in the auto position and/or the arming lanyard catches on something and is inadvertently pulled. Ten of the 37 mishaps involved the Koch actuator.

Nine of the 37 involved the Model 7000 Automatic Parachute Release because of similar errors. The arming knob caught on something during parachute movement.

These two items alone accounted for more than half of the first half-year's egress mishaps. The other half were even more dangerous and could well have started a short time and distance trip through lower space for some unfortunate body. It's happened before, you know. For heaven's and egress' sake, know what you're doing and do it right—BY THE BOOK. If you're in or around aircraft cockpits, you must be qualified and current in accordance with AFR 66-51.

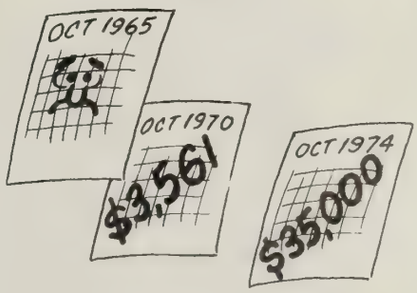


LEST WE FORGET

Ten years ago, damage to a Minuteman missile resulted when the lock retainer fell into the launch tube during the opening of the launcher closure door. Cause was incorrect centering of the cable pin in the rocker arm.

Five years ago, at a Minuteman launch facility, a battery charger failure caused the removal and replacement of 18 batteries. The cost of the nonreparable batteries was $3,561.

One year ago, a lightweight berryllium spacer sustained nonreparable damage of $35,000 during routine maintenance at a Minuteman launch facility when the reentry vehicle assembly was inadvertently lowered during final mating adjustments, striking the penetration aid spacer. ★



Mail Call



I read Lt Col Owen A. Heeter's July 1975 article on Losses in Private Flying with careful interest because I'm one of the guys I *don't* want his statistics to talk about.

My Air Force duties (auditor) require that I push a pencil rather than a throttle, but I still enjoy private pilot privileges while off-duty. I'm one of several Air Force private pilots unfortunate to be at a base not having an aero club. Therefore, I must satisfy my addiction (and it really is one, you know) on the commercial market.

So, I have two points I want to make. Number one, thank you, Colonel Heeter for showing yet one more reason why the Air Force should promote Air Force aero clubs as a matter of policy. That is, we're going to fly whether the base has an aero club or not; therefore, let's promote an Air Force-managed (regulated and safe) operation. Second point is, keep us in mind when writing your magazine. Even though mission-orientation for you is to the Air Force pilot, crewmember, and maintenance people, we private types are also interested in safety. Several times I've found your articles could be applied to my type of flying as well as yours—e.g., weather, pilot-decision, flight planning, pre-flight maintenance, operations, etc. Keep up the good work. ★

ARLEN E. BRADLEY, Capt, USAF
Air Force Audit Agency Office
Kelly AFB TX 78241

USAF AERO CLUB SAFETY RECORDS

Thirty-two United States Air Force Aero Clubs will receive the Federal Aviation Administration's Annual Flight Safety Award for completing a full year of flight operations in calendar year 1974 without a single aircraft accident or incident.

The awards, consisting of engraved plaques, will be presented to the winning aero clubs at individual ceremonies throughout the country conducted by FAA Flight Standards District Offices.

For the Norton AFB, California, Scott AFB, Illinois, and RAF Bentwaters, England, Aero Clubs, it will be their fifth consecutive annual award for achieving an accident free year.

The 32 USAF Aero Clubs qualifying for awards for 1974 are: Barksdale AFB, SAC, Bentwaters/Woodbridge, USAFE, Bergstrom AFB, TAC, Chanute AFB, ATC, Craig AFB, ATC, Duluth IAP, ADC, Edwards AFB, AFSC, Eielson AFB, AAC, England AFB, TAC.

Elmendorf AFB, AAC, Ent AFB, ADC, Hamilton AFB, AFRES, Hickam-Wheeler AFB, PACAF, L. G. Hanscom AFB, AFSC, Langley AFB, TAC, Little Rock AFB, MAC, Lowry AFB, ATC, Misawa AFB, PACAF, Moody AFB, ATC, Norton AFB, MAC.

Patrick AFB, AFSC, Ramstein, USAFE, Robins AFB, AFLC, Scott AFB, MAC, Seymour-Johnson AFB, TAC, Shaw AFB, TAC, Sheppard AFB, ATC, Torrejon, USAFE, Travis AFB, MAC, Tyndall AFB, ADC, USAF Academy, USAFA, Vandenberg AFB, SAC. ★

☆U.S. GOVERNMENT PRINTING OFFICE 1975 789/855/26

ED STATES AIR FORCE

Well Done Award

Presented for

outstanding airmanship

and professional

performance during

a hazardous situation

and for a

ignificant contribution

to the

nited States Air Force

Accident Prevention

Program.



Captain
Donald C. Bulloch

Captain
Maury Rosenberg

1st Strategic Reconnaissance Squadron
9th Strategic Reconnaissance Wing
Beale AFB, California

On 24 September 1974, Captain Rosenberg, pilot, and Captain Bulloch, RSO, were flying an SR-71A at an overseas operating location. While they were descending through 77,000 feet, in excess of Mach 3, the fourth stage compressor of the right engine completely disintegrated. Shrapnel damage to fuel, oil, and hydraulic lines resulted in an intense fire in the right engine nacelle. The loss of thrust and high drag condition accompanying the engine failure combined to create pitch, yaw, and roll oscillations which drove the aircraft close to the limits of stability. During the emergency descent the situation was made extremely dangerous when the left engine flamed out because of air starvation, leaving the aircraft with only battery powered systems. Engine and airframe vibrations were so severe that the crew was battered about the cockpit, making it almost impossible to read instruments or checklists. The situation was compounded by loss of cabin pressurization and inflation of the crew's full pressure suits, further hampering capabilities within the cockpits. Despite these complications, Captain Rosenberg and Captain Bulloch were able to complete all emergency procedures for the right engine failure and fire and accomplish a successful airstart on the left engine. The aircraft was recovered single-engine without further incident. The exceptional skill and prompt action on the part of Captain Rosenberg and Captain Bulloch, and their thorough knowledge of the SR-71 aircraft systems and checklist procedures, prevented the loss of an extremely valuable aircraft. WELL DONE! ★

THERE IS A LOW LEVEL, HIGH SPEED
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USAF C-130 dumps fire retardant on flames during forest fire. Photo by SMSgt Stephen Micklas, HQ Air Force Audio Visual Center (MAC), Norton AFB CA.

UNITED STATES AIR FORCE NOVEMBER 1975

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THE MISSION - - - - - - SAFELY!

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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NOVEMBER 1975 AFRP 127-2 VOLUME 31 NUMBER 11

CONTRADICTIONS IN MIDAIR COLLISION PREVENTION?



LT COL S. G. HENLEY
Directorate of Aerospace Safety

We appear to live in an age of contradictions. While we can take pride in the advances made in aviation safety over the past half-century; we must feel some guilt for the lack of progress made in our ability to avoid colliding with one another.

This lack of progress is painfully evident when we consider the fact that the "see and avoid" method of collision avoidance used in 1918 is still the "law of the air" in 1975. It was fairly effective then, but it has become increasingly less effective as air traffic density and aircraft speeds increase. What is even more unnerving, the Department of Transportation estimates the civilian aircraft population will be almost 280,000 by 1986 and the number of military aircraft to exceed 10,000. All of these aircraft will be competing for their share of the national airspace; and the prediction is that, unless some changes are made now, many will attempt to occupy the same airspace at the same time, with the inevitable results.



Photo of radar scope showing traffic in area near Ontario, California. This radar is latest in air traffic controller's equipment for preventing midair collisions.

Recent midair collisions within the USAF have emphasized the seriousness of the problem. In 1974 there were seven midair collisions involving USAF aircraft. Those accidents caused ten fatalities. This year we have experienced two midair collisions resulting in nine fatalities.

The problem is clear—the solution is not! Part of the solution is education, and that is the reason for this article. Experience has shown that when we are aware of a dangerous situation, we tend to be cautious. On the other hand, when the situation *seems* to be conflict-free, we are likely to let our guard down. Let's see where we should be cautious.

WHERE DO MIDAIRS OCCUR?

In May 1973, the MITRE Corp., under contract to the FAA, performed an extensive analysis of civilian midair collisions for the period January, 1964—December 1971. Although oriented to the civilian community, the analysis is valid for military aviation as well since we all use the same national airspace, for the most part. (NOTE: It is important to keep in mind that midair collisions accounted for only 5% of all fatalities produced by civil aviation accidents during the eight-year period studied. The midair collision is, historically, the source of only a small fraction of aviation-related fatalities, but admittedly it is an exceptionally visible and important source).

MITRE analyzed 271 collisions. Only fifty (18%) of those collisions involved some level of Air Traffic Control Services. Only two collisions occurred between aircraft that were both IFR and being provided separation at the time of the collision. In both cases, the collision was a direct result of the pilot deviating from a conflict-free IFR clearance.

Fourteen collisions occurred between a controlled IFR aircraft and an uncontrolled VFR aircraft. In all but one case, the VFR aircraft was not in radio contact with any ATC facility. The analysis revealed that there were no collisions between a controlled IFR aircraft and a VFR aircraft receiving radar sequencing and advisory or separation service from a terminal radar facility.

In seven of the fourteen collisions, the VFR aircraft was not seen by the radar controller. In no case was the VFR aircraft carrying an operating beacon transponder or in radio contact with an ATC facility prior to the collision.

The MITRE study concluded that the greatest threat to air carriers (and we could add IFR-military aircraft) is the lack of transponder equipped general aviation aircraft in busy traffic areas. (NOTE: Transponders are required by law to be on all aircraft operating in controlled airspace.) In addition, they concluded that no midair collision occurred during the eight-year period studied, when both aircraft were: (a) identified and under radar beacon surveillance, (b) under positive control, and (c) both pilots conformed to their ATC clearance. Finally, they said that IFR-VFR midairs in busy terminal areas represent the prime civil aviation collision problem to be solved. The terminal area they referred to was defined as below 10,000 feet and within 30 miles of an airport served by a radar approach control facility.

O.K. so we have a pretty good idea how and where the collisions occur, but we need to know why they occur!

THE HUMAN SIDE OF THE MIDAIR

The pilot has been held responsible for "seeing and avoiding" ever since Wilbur said to Orville, "Let's build another one." But, there are some important psychophysiological limitations that lead us to question the total concept of "see and avoid."

Factors that affect visual acuity are many and all tend to place the pilot in a situation over which he has little control.

Foveal or focsed vision enables the pilot to discriminate between small objects at various distances. This is a plane of focus that lies within a 20 degree cone from the center of the eye. Objects outside this cone are not in focus since they lie in the area of peripheral vision. Therefore, for the pilot to visually perceive an aircraft that may be a threat to him, he must constantly move his eyes and refocus them in order to evaluate the threat.

Phenomenon important to your ability to see a distant aircraft on a hazy day is called "altitude myopia" or "nearsightedness." This phenomenon occurs when visual contrast is decreased; that is, at altitude, or as a result of haze, smog, glare, etc. As you search the horizon for other aircraft, your focal point tends to recede back toward the eye with the passage of time. The eyes tire, relax, and you become nearsighted with the focal point resting between 15-20 feet away. So fatigue and boredom play an extremely important role in the general scanning habit, and the effectiveness of scanning is dependent on training and time-sharing of activities inside and outside the cockpit.

Let's talk for a moment about cockpit activities as they relate to scanning. We have learned, to this point, that most midair collisions take place below 10,000 feet and within 30 miles of a radar facility. When is the pilot his busiest, with his head in the cockpit? The answer to that is—below 10,000 feet and within 30 miles of a radar facility during an approach or departure procedure!

Just when our attention is demanded *outside* the cockpit, it is also required *inside* the cockpit (another contradiction); but, we can reduce the danger of this situation by increasing our concern for what is happening outside the cockpit; that is, look around for other aircraft! *You know* radar controllers cannot see *all* the traffic that may affect your flight. It is almost suicidal to think that those words "radar contact" mean you cannot be run into by another aircraft.

Looking outside of the cockpit may take considerable effort on your part due to cockpit design.

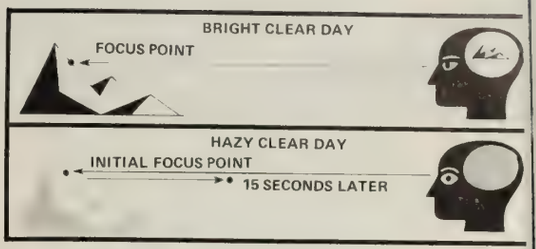
COCKPIT DESIGN/THE MIDAIR

The National Transportation Safety Board studies of midair collisions continue to have a connecting thread of similarity to them. In many of the accidents the pilots admitted seeing the other aircraft but lost sight of it somewhere in the traffic pattern. In almost all of the midair collisions, it was determined that at least one pilot was in a position to see the other aircraft, but cockpit obstructions such as window posts, opaque sunvisors and instrument panel shields restricted the pilot's view.

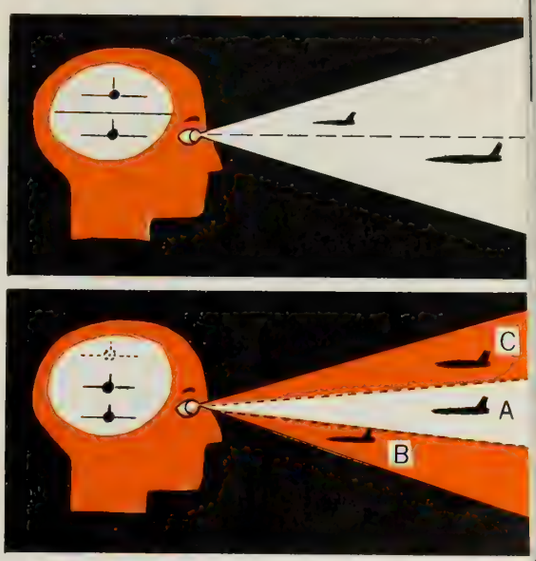
Although the NTSB studies were concerned with civilian aircraft, military aircraft have similar visibility problems. Again, we collide headon into a major contradiction. In order to provide strength to canopies and windscreens, designers must use center posts, canopy bows, support members, etc.—all vision restricting. A clear bubble canopy, although great for visibility, in most instances, cannot take a birdstrike at 400 kts. So, just when the designers come up with a suitable canopy or windscreen that will take a hit (bird) at high speed the increased thickness causes major distortion problems. The point I'm making here is that the cockpit, as it is designed, presents another problem for the pilot when scanning for other aircraft. It will require you to make a concerted effort to see around the cockpit obstruction—you can't be lazy if you want to see outside.

STROBE LIGHTS AND PAINT

Now, if we do all of the focusing and refocusing, and looking around windshield supports, are we going to see anything? The only thing I



This demonstrates another phenomenon very important to your ability to visually clear your flight path on a hazy day. We refer to altitude myopia or nearsightedness. This phenomenon occurs when the visual contrast of man's environment is decreased, e.g., at high altitudes, or as a result of haze, glare, etc. Essentially, when one focuses on a distant point through haze, the focus tends to recede back toward the eye with the passage of time, which simply means that it is difficult to continually focus on an indistinct object. The eye tires, relaxes, and we become "nearsighted."



Upper drawing demonstrates that a smaller object would appear as large as a bigger but more distant object. Lower drawing illustrates the decrease in visual acuity with the angular separation of an object from the cone of foveal (focused) vision. A pilot's eyes are focused on aircraft "A." Note that aircraft "B" is outside his cone of foveal vision and much closer. However, the pilot's mental perception of aircraft "B" is hazy although larger, while aircraft "C," at the same distance as aircraft "A," is perceived as being much smaller and more indistinct.

CONTRADICTIONS continued

can say at this point is that if the other guy has strobe lights on or is painted conspicuously you have a better chance of seeing him.

We (USAF) recently completed an evaluation of strobe lights on T-39, T-38, FB-111, B-52, C-141, and KC-135 aircraft. The evaluation concluded that ". . . the high intensity strobe light is a significantly more effective m i d a i r collision avoidance device than the standard rotating beacon." Two out of the three major commands participating in the evaluation concluded that ". . . during daylight hours strobe lights substantially increased aircraft conspicuity. . . ."

Conspicuity painting is a somewhat controversial subject. It is one of those things that we are sure helps but, as yet, we can't prove it. Most studies conducted on conspicuous paint schemes have been empirical in nature. The US Army has performed extensive evaluations to determine the most suitable paint scheme for their helicopters. They have come up with an alternating pattern of white and black which results in a flashing effect when observing the helicopter from above. The idea, of course, is to break up the color pattern so that it contrasts with the background. Do you detect a contradiction at this point? You are right! The contradiction is the necessity of camouflaging aircraft so the enemy can't see them, but at the same time, making them visible so we can!

Although by no means scientific, in my experience I have been able to see orange and white FAA flight check aircraft and similarly painted Navy aircraft at greater distances than other aircraft. It seems that conspicuity paint schemes may offer the greatest return for the least invested of all the collision avoidance systems we have tried.

Well, we have talked about a great many things that contribute to the midair collision problem and a few things that may help alleviate it. As I said in the beginning, the solutions are not easy to define. Work is being done in the area of collision avoidance systems and improved air traffic control. The increase in the number of terminal control areas (TCA's), terminal radar service areas (TRSA's) and general radar services being provided to the participating pilot is a part of the solution. Most of the solutions are expensive and a long way off. This translates into "see and avoid" will be with us for some time. And, in the uncontrolled airspace, will probably be the basis for avoiding a collision into the 1980's and beyond. So, as a pilot, here are a few things you can do to reduce the potential for a midair:

- Improve your scanning techniques and be aware of your physical limitations and those created by the cockpit design.
- Constantly remind yourself that "radar contact" does not relieve you of the responsibility of looking around.
- When scanning the horizon at altitude or in a hazy sky condition, periodically change your focus to inside the cockpit; then range out again at the horizon.
- Move your head so you can see around cockpit obstructions.
- Use radar traffic service whenever it is available. (The statistics clearly favor the radar-controlled side of the midair scoreboard.)
- Turn on all the external lights you have on the aircraft when approaching a terminal area at night and in the daytime in poor visibility conditions (that means landing lights, ice-check lights, or whatever).
- If you are executing a radar approach or departure and the controller says he has traffic near you, request separation from conflicting traffic. (It will put a jink or two in your GCA, but it may be worth it.)
- Finally, report all near midair collisions to the nearest ATC facility and your safety office. ★

Have you ever flown a non-precision approach to minimums in the weather, only to break-out at the MAP and find the runway wasn't where you thought it should be? If it hasn't happened to you, it probably will. This article provides information to help you locate the runway environment at the earliest possible time so you can make a safe, successful landing. A discussion of approach design criteria contained in AFM 55-9 should assist you in visualizing your position in relation to the landing runway.

First of all, you should understand how the TERPS designer determines whether straight-in or circling minimums will be published for a particular approach. For an approach designed using a navigational aid located on the field, straight-in minimums may be listed if (See Fig 1):

a. The angle of convergence between the extended runway centerline and the final approach course does not exceed 30°; and,

b. The extended runway centerline and final approach course intersect at any point between the runway threshold and 5200 feet out from the threshold.

If these criteria can not be met, straight-in minimums may still be published if the final approach course is not displaced more than 500 feet laterally from the runway centerline at a point 3000 feet from the runway threshold. (See Fig 2)

The criteria for navigational aids located off-airport are slightly different. The angle of convergence requirement remains a maximum of 30° between the extended runway centerline and the final approach course. However, the final approach course must intersect the extended runway centerline at any point from

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

THE IFC APPROACH

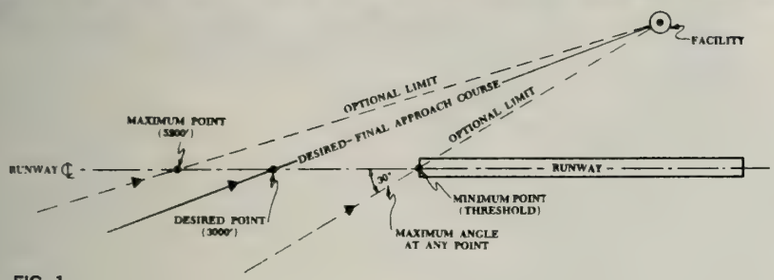


FIG. 1

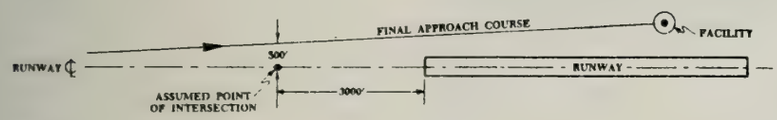


FIG. 2

the runway threshold to a point 3000 feet out the extended runway centerline. If the above criteria can not be satisfied, then only circling minimums may be published.

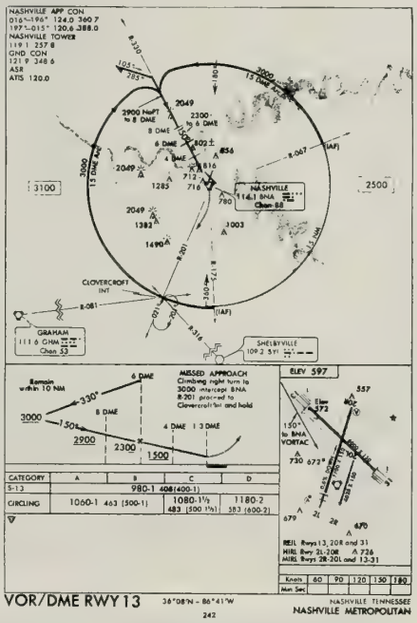
Important points to consider when you start looking for the runway are the possible ground equipment, airborne equipment, and pilot errors. These errors when combined, using the laws of probability, may be as much as 4.5°. The amount of aircraft displacement from the published final approach course, caused by this error, is directly proportional to the distance from the NAVAID to the flying machine. For example, if the MAP is two miles from the NAVAID, a 4.5° error would result in a lateral displacement of approximately 180 ft. If, however, the MAP was located 10 miles from the NAVAID, and you had the maximum of 4.5° total error; you would be displaced approximately 900 feet from the published MAP. There is no way to plan what the cumulative equipment error might be in a certain aircraft on a particular day. The thought to remember is that you may have to look around to find the runway.

We hope that the above information substantiates the fact that the runway may not be off your nose (unless you turn your head) when flying non-precision approaches.

OK then, let's look at a procedure (Fig 3) and discuss what pilots can do to determine where to look for the runway environment after reaching MDA.

First, compare the difference between the magnetic heading of the runway and the final approach course. Looking at the aerodrome sketch in Figure 3, we find a difference of approximately 20°. We know that we will have to look to the left. (Hope the canopy rail or windshield center post doesn't block my view.) The next thing to do is to look at the profile view. What is the distance relationship between the MAP and the runway threshold? In our example, the MAP is at the runway threshold. Looks like it would be desirable, (if not mandatory) to get down to the MDA prior to the MAP in order to land straight-in out of this approach.

Finally, look back to the aerodrome sketch. Try to form a picture in your mind of the relationship between the runways, taxiways, and ramp area. At your home base, this should be no problem; but at a transient base you should look for such things as the control tower, the placement of the airfield rotating beacon and the aircraft hangar area. By having this information firmly fixed in your mind, even if you are slightly displaced from the final approach course when you break out, you will be better able to determine your position in relation to the landing runway.



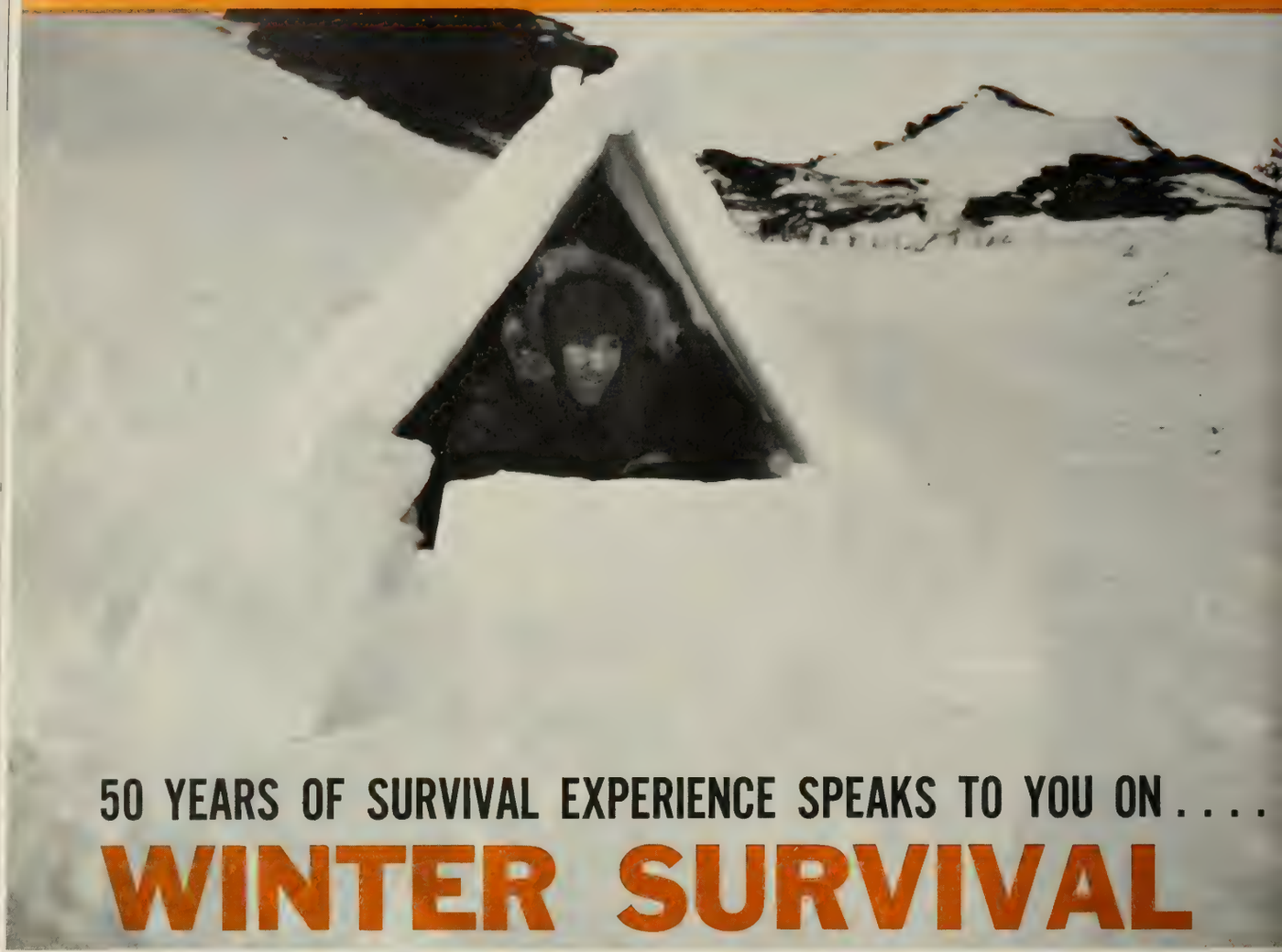
VOR/DME RWY 13
NASHVILLE METROPOLITAN
APPROACH

In summary, study the instrument approach procedure prior to commencing the approach so you will have an idea of where to start your visual search for the runway. You should also understand that a straight-in landing may not be possible if you fly a non-precision approach all the way to the MAP.

The techniques for flying the approach discussed here are not new nor revolutionary. They have been contained in AFM 51-37 for years. However, their very familiarity makes it important that we review them periodically. When you have to make a real IMC approach to minimums it's too late for a review of procedures. ★

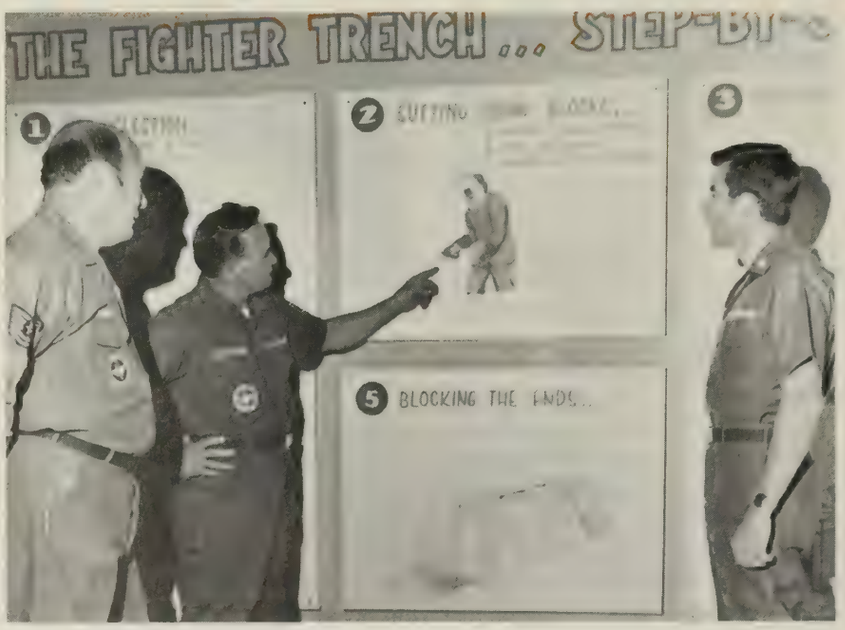
WINTER SURVIVAL

LT COL THOMAS R. SCHORNAK
Chief of Aircrew Training
3612th Combat Crew Training Squadron (Survival) (ATC)
Fairchild AFB WA



50 YEARS OF SURVIVAL EXPERIENCE SPEAKS TO YOU ON

WINTER SURVIVAL



Survival experts TSgt James D. Baugh, MSgt. Thomas L. Litzinger and Lt Col Thomas Schornak at display in Air Force Survival School at Fairchild AFB, Wash.

Editor's Note: *MSgt Thomas L. Litzinger and TSgt James D. Baugh were survival instructors who specialized in arctic and subarctic climates. Their extensive experience included assignments in Laborador, Greenland, Canada, the USAF Survival School in Eielson AFB, Alaska, and the Arctic ice pack. On the eve of their retirement they met in the office of Lt Col Thomas R. Schornak, 3612th Combat Crew Training Squadron (Survival) (ATC), Fairchild AFB, Washington, to pass along to you the crew member, some of their parting thoughts on winter survival. Naturally, it makes no difference how you get into a winter survival episode—a stalled car in a midwest blizzard has the same effect as a burning bomber over Greenland.*

WINTER SURVIVAL

Lt Col Schornak Depending on the time of winter, a large part of the CONUS land mass could certainly, by definition, be classed as an arctic environment. We cannot cover the entire spectrum of winter survival topics, so let's open with a discussion on the primary environmental factor—C O L D!

TSgt Baugh The variables of that definition are endless, and they always go back to the individual and how he was prepared before he entered the survival situation. Did he have the proper clothing, equipment, and survival training before departing? In other words, was he ready mentally and physically for a possible survival situation?

MSgt Litzinger A good example is the fighter pilot or bomber crew member ejecting in the arctic. With his life support gear, he'd probably be better able to adapt to his situation than an aero club member, with light clothing and inadequate footwear, making a forced landing in an Ohio corn field. If the average pilot could only see an Air Rescue crew member departing on a mission in the arctic! He leaves *nothing* to chance and is prepared for the worst. Every pilot and crew member should feel the same way.

Lt Col Schornak Let's talk more about the necessary preparation. How does it pertain to the individual crew member?

TSgt Baugh Well, if he can't attend the USAF Arctic Survival School in Alaska, the next best thing is to review AFM 64-5, *Survival*, and recall some of the basics taught at Fairchild. Most base libraries can supplement this basic information and can provide interesting reading.

MSgt Litzinger Crew members flying with survival kits had better insure they know what is packed inside the kit, as well as how to use the equipment. I recall one case where we were on a search mission and found the pilot had died of exposure. Right next to him was an unopened sleeping bag, still packed in its vacuum container.



TSgt Baugh Depending on the mission and the geographic location, flying units will vary the items of survival equipment placed in the kits. After reviewing what is packed in a particular kit with the Life Support people, the crew member may want to carry some supplemental items in his flight suit. High on the list of personal items would be a wool stocking cap which has proven to be useful on those cold preflights, as well as its potential benefit for a survival situation. Some researchers have stated that 50% of the body heat escapes from the head, so you can see this is an important item for conserving body heat.

MSgt Litzinger Let's emphasize again that wool is the best choice for hats, socks, and thermal underwear because of its unique qualities to provide insulation when wet. Here is another point of interest: Eskimo school children have a routine that is effective. They put on one pair of socks, cover them with a plastic baggy, then put on another pair of socks. Although the inner sock will retain moisture, the baggy keeps the second sock dry; this provides a dry, dead air space and preserves the insulating qualities of the second sock. An extra pair of wool socks and two plastic baggies could be easily carried in a flight suit pocket.

TSgt Baugh Due to the shock and anxiety of finding oneself in a sur-

continued



To stay alive is the name of the game in winter survival.



Without proper equipment and know-how this lightplane pilot could be in serious trouble.

vival situation, dehydration is always a factor to be considered.

Lt Col Schornak I can certainly attest to that. Our post-rescue reports in SEA almost always had a reference to an unquenchable thirst. Physical activity and shock undoubtedly contributed to this craving for water.

TSgt Baugh Arctic temperatures are generally dry, sometimes as low as 5% humidity. This, in conjunction with a survival situation, will result in rapid dehydration. Eating snow could be dangerous because precious calories needed to sustain body warmth are diverted to melt the snow. More people involved in outdoor activities should be aware of this potential hazard.

MSgt Litzinger Again, we can go back to an old Eskimo practice accepted by the Air Force and taught to the students at Fairchild in the winter. Take a plastic water bag (NSM 8465 00 485 3034—$.50 each), fill with snow, and place between layers of clothing to melt snow for drinking water. Again, the plastic container can be folded to fit in a flight suit pocket.

Lt Col Schornak Of course, keep in mind the byword "don't use yellow snow."

MSgt Litzinger When engaging in physical exercise or generating an excess of body heat, don't forget to ventilate the layers of clothing to keep perspiration from dampening clothing and breaking down the insulation value.

Lt Col Schornak For that unfortunate crew member who experiences a winter ejection—he can count on an extremely cold ride to the ground. He must remember, and take positive action, to protect his hands. Generally, flying gloves are inadequate even for a short descent. It would be helpful to place his hands under the armpits of his flight clothing for additional protection; then, prior to landing assume the proper body position.

MSgt Litzinger Once safely on the ground, place the survival radio and any extra batteries as close to the body as possible to keep them warm. Cold batteries will lose efficiency and may not operate the radio. That radio is the primary link between survivor and searcher—take care of it! While on the subject of ground-to-air signals, it is important to remember uses of the MK-13 signal flare and the signal mirror. In the winter make ground signals symmetrical and obtain as much contrast as possible. For example, snow blocks casting shadows or the red smoke or flare from the MK-13 against white snow. Be ready to signal the rescue aircraft. That one pass over the survivor's area may be the only one that day!

TSgt Baugh There is a great variety of shelters, so rather than try to remember them all, just keep the basic principles in mind. Remember that snow is insulation, and heat for a shelter could be obtained from body heat or even radiant heat from the earth. To obtain maximum benefit of radiant heat, clear the area as close to bare earth as possible. The shelter should have a minimum of eight inches of snow on top of a framework which is as air tight as possible.

Lt Col Schornak Proper ventilation for the shelter is something the survivor must decide for himself. Even a slight opening will cancel the benefit of body and the earth's radiant heat. Snow will naturally breathe, but a completely air tight or glazed over shelter may not provide adequate ventilation.

Lt Col Schornak We are unable, here, to go into all the aspects of winter survival so the reader should take advantage of his life support personnel and the vast amount of reference material available. As in any tough situation, mental preparedness and proper equipment are the tie breakers which allow the survivor to control his predicament. Don't ignore the tie breakers! ★

NOTES FROM A LINE CHIEF'S DIARY



HOW TO SPOIL A WEEKEND

Today started out fine. The weather was warm and as I drove to work the weekend forecast was great. Looked like the camping would be super. When I got to the line everything seemed okay, so I checked the forms and started getting our first F-4 ready for launch.

I was just buttoning up door 23 after bleeding the utility system when the pilot called and told me he had a problem. I went over to the truck and called for red ball specialist support. Pretty soon the specialists came and we got the bird launched just about on time.

An hour or so later I was taking a break for a cup of coffee when the OMS line supervisor came in and asked who had launched 684. When I told him I had, he said "You'd better come with me" and we went up to the OMS office. I figured something was w r o n g when I saw the guys from QC and a major from wing safety. Capt Sullivan, the OMS supervisor, asked me who had bled the utility system. I told him I did. Then he asked, "Do you remember fastening the door?"

I started to say "Of course" when I remembered that was what I was doing when I went to call in the red ball. I had thought that Tom, my assistant, had closed the door. Sgt Quinn from QC asked me if I'd told Tom to close it. I hadn't. By this time I was getting worried, so the major explained that 684 had come back minus part of door 23 and that the four forward fasteners had been left undone.

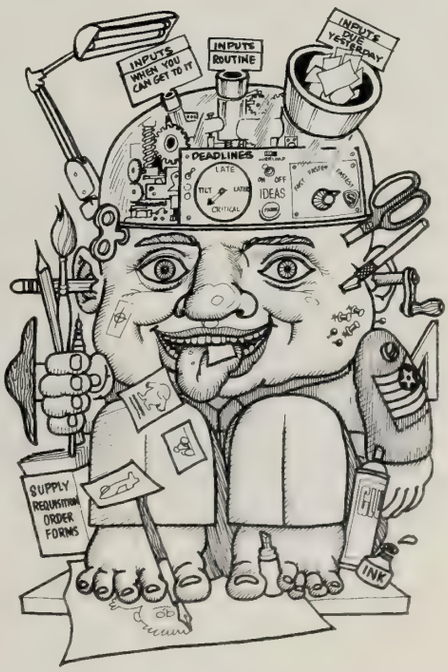
Well, I'm not enjoying my camping quite as much this weekend because I'm supposed to be in the office of the Chief of Maintenance at 0800 on Monday. I don't have to guess what he wants to talk about. ★

Artist Wanted

We are looking for a sharp, hard-working USAF graphics technician, AFSC 23171, preferably in the grade of Tech Sergeant. The position is Art Director, USAF Safety Officers' Study Kit. A commercial art background is desirable, with a working knowledge of photography, strip and paste-up, poster design, lithography prep, color separation and a diverse multi-art capability. The slot is a MSgt's so you've got something to shoot for. It's strictly a "board job" with short deadlines and oftentimes pressure projects so only a man who likes a challenging but rewarding experience need apply.

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Capt John Richardson,
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Editor
Safety Officers' Study Kit
AFISC/SEDAK
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A Great Way To Die



MAJOR LAWRENCE E. WAGY
Directorate of Aerospace Safety

In the late 1960's, I was rotating quite regularly to a sunny spa in northern Italy. On a few occasions I was allowed out of the pen (VICTOR alert) to practice my far from excellent bombing techniques. The particular day I now recall was atypically overcast at about 1500 feet. I was flying in the number two position and the "old head" flight lead was already off wet from a LADD (Low altitude Drogue Delivery) and had disappeared into the overcast. Looking back now, I don't recall even contemplating how I was going to recover from my 45° climb, until the bomb release light came on simultaneously with my punching smartly into the beautiful fluffy clouds.

Making a hasty, if not sound, decision I rolled the aircraft inverted on the attitude indicator and pulled back on the pole. Just as I was congratulating myself on an impressive IMC instrument maneuver, I came screaming out the bottom of the overcast in a dive angle I am embarrassed to estimate, with an airspeed of 450 kts, and

nothing in sight but trees which were growing larger at an unbelievable rate. The adrenaline in my system produced a recovery that astounded aerodynamicists, who argued that it was impossible. I suspect they were failing to account for ground effect.

As the years passed by, I purposely forgot this instance, along with a few others from my luckier —rather than skillful—years. Then recently, while reviewing range accidents, I came across one that sent a chill up my spine. Here is a direct quote from the accident report:

"The pilot had completed two radar laydown events and was executing his first radar LADD when the accident occurred. He was observed to make a normal run-in with a pull-up 3000-5000 feet short of the normal pull-up point. Range personnel confirmed this and reported he appeared to enter a cloud at 2- to 3000 feet AGL. He was next observed several seconds later as he reappeared below the clouds in a near vertical attitude. Witnesses stated that an attempt apparently was made to recover to a level attitude prior to impact."

My study of air-to-ground accidents concerned only those in which *no aircraft malfunction* was involved. Thirty-four accidents of this nature have occurred since 1 January 1970. Chart A indicates that, with the exception of 1971, the total fatalities per accident is significantly higher in the subject accidents than the overall fighter accident record. The reasons for this high fatality rate are several:

The very nature of the mission, i.e., high airspeed, low altitude maneuvering flight, is an obvious factor.

When trouble occurs or is recognized, the safe ejection parameters are not there.

Sixty-six percent of the studied accidents involved the pilot placing the aircraft into a position from which he could not recover. Invariably this situation is not recognized by the aircrew until the recovery phase where he is often the victim of a high sink rate. Thus when the aircraft is unrecoverable, often so is the aircrew.

There was a time, I remember, when range safety officers and forward air controllers reaped their share of the findings in range accidents. Although 62 percent of the study accidents were operating with either a forward air controller (FAC) or a range safety officer, I was pleasantly surprised that no accidents in this group contained findings associated with the action or lack of action by either the FAC or the range safety officer. Internal flight control/supervision did not fare as well and was a factor in 22 percent of the accidents studied.

I next divided the subject accidents into those on scorable, controlled ranges with limited fixed patterns, and those in a tactical delivery environment where realistic patterns and attacks are the option of the flight leader. This latter group includes simulated close air support missions and simulated interdiction attacks. Only 41 percent of the subject accidents occurred on scorable controlled ranges, whereas, 59 percent occurred in the less restrictive tactical delivery environment.

Several factors make the realistic tactical environment more hazardous. The target terrain is less familiar to the crew and often involves more vertical terrain development. The lack of standard ground reference points with less rigid initial altitudes results in less accurate delivery parameters. Realistic tactical targets do not provide the pilot visual slant range estimation as well as the well-defined scored range targets. None of this is news to fighter pilots.

The possibility that planned dry delivery accidents are more dangerous than hot passes did surprise me. I defined dry delivery accidents as those accidents which occurred when the pilot had no intention of dropping ordnance at the initiation of the delivery. This would include all simulated attacks. Nine accidents occurred on dry passes. This amounts to 31 percent of the accidents which occurred during the delivery or recovery phase. The planned dry ordnance delivery is more vulnerable to inaccurate recovery techniques and possibly more susceptible to target fixation. In the tactical delivery environment a dry pass, particularly when in support of ground forces, is a setup for intentional low altitude, high speed passes. Basically, a pilot intent on dropping a good bomb will pickle and recover as near as possible to the predetermined release altitude. When no intention to drop exists, recoveries can, and often will, be delayed.

CHART A
TOTAL FATALITIES PER ACCIDENT

	1970	1971	1972	1973	1974	1975
Subject Accidents	1.13	.6	1.8	1.57	1.17	1.5
All Fighter Accidents	.45	.43	.81	.54	.52	.92

A Great Way to Die continued

I also evaluated the weather factor in these accidents. Three criteria determine range weather requirements: minimum ceiling, minimum visibility, and instructions to stay out of the clouds. The major weather threat, if the ceiling is such that aircraft stay in VMC, appears to be loss of a visual horizon. At present regulations do not require a well-defined visual horizon. The weather accidents indicate that in recent accident experience, weather minimums are not being violated with the exception of aircrew failure to stay in VMC conditions.

The 34 aircraft accidents produced 64 significant findings. In an attempt to get to the heart of these mishaps, I simplified these findings into seven categories.

Category I. The pilot placed the aircraft in a position from which a safe recovery was impossible. (Found in 66 percent of the accidents).

Category II. The pilot became disoriented. (31 percent)

Category III. Supervision, not within the flight, was found lacking. (28 percent)

Category IV. Supervision, within the flight, was found lacking. (19 percent)

Category V. The pilot at the controls stalled, spun, or overcontrolled the aircraft. (19 percent)

Category VI. Range weather contributed to the accident. (13 percent)

Category VII. An instructor pilot failed to take positive action to prevent an unsafe situation (13 percent). Reports containing either Category I, II or III accounted for 91 percent of the accidents.

Analysis of the experience of aircraft commanders in the subject accidents indicates 30 percent had below 500 hours total FP/IP time. Seventy-seven percent had less than 500 hours experience in their particular aircraft type. (Chart B.)

CHART B

FLYING EXPERIENCE

	TOTAL FP/IP		TOTAL FP/IP UE	
	Less Than 500 Hrs	More Than 500 Hrs	Less Than 500 Hrs	More Than 500 Hrs
Weather Factor Accidents	60%	40%	100%	0%
Night Accidents	13%	87%	75%	25%
Tactical Accidents	25%	75%	69%	31%
All Air-to-ground Accidents*	30%	70%	77%	23%

*Without aircraft malfunction

It is noteworthy that in all weather factor accidents, the pilot had less than 500 hours in the aircraft.

Almost ⅓ of these accidents occurred at night. This analysis did not reveal any hazards peculiar to night operations. The already identified hazards are, however, amplified at night due to conditions which promote disorientation and limit visibility. Target orientation is more difficult and less accurate delivery parameters can result. At night the aircraft instrumentation must be monitored more closely than during day operations.

My original reason for writing this article was to point out several ways to prevent your untimely demise. On second thought, considering the keen competition for fighter assignments, I have elected to describe "a great way to die."

First, you must find a bad flight leader to take you out. Make sure he is one who doesn't care about the weather conditions of the target area as long as they meet the minimum requirements. This flight leader will certainly overlook any consideration of your experience level in determining the mission profile.

Second, pick out a mission that involves realistic tactical maneuvering for which you have had only minimum training. It will be a lot easier to achieve the stated goal if you can be working with the army and plan simulated attacks against a moving tank column on a hilly road.

If you are stuck with dropping bombs on a range target, you are faced with a bad situation. Although you plan to die, you surely don't want a bad bomb. The solution is to call in dry. Now you can kill yourself without ruining your bombing average.

For the crowning blow, "the moment of truth," so to speak, I recommend a pop-up delivery. Don't pull up too soon or too high. Now, roll over on your back and wait until the target is directly under you. Pull the nose down until you're aimed just short. If you've done this maneuver correctly, and it isn't hard to do, you'll end up too steep, too fast, too low and probably dead. The neat thing about this maneuver is that you can place the aircraft in a position from which recovery is impossible, and at the same time, place yourself out of the ejection parameters. If you misjudge the maneuver and give yourself enough room to recover, just overcontrol and stall the aircraft at the bottom of the dive and hang on.

Now, if you are a real "smoothie" and can't handle either one of these maneuvers, disorientation is the only way out. Best plan this for night attacks, although day low visibility will do. I much prefer night over the water with an overcast sky. This one is really easy. Select any point in the pattern you want. Lose your concentration for a second. Now don't peek at the flight instruments. You will never know what hit you! This has just got to be "a great way to die." ★

Self Medication That Works...

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Over the past 10 years the United States Air Force has seen some spectacular improvements in its aircraft and weapons systems. These advances stem directly from improved materials and technology. Unfortunately, the human body has not enjoyed such a revolution technically in the past 10,000 years! Mentally, we have kept the pace but our hearts, lungs and other organs necessary for life show little change over the early models. How then can we compensate—how do we physically handle the increased demands of the highly sophisticated new machines advancing technology produces? The answer is a stiff dose of self medication—one the Flight Surgeon has approved.



It has been almost 10 years since Dr. Cooper's article, "Flying Status Insurance" appeared in AEROSPACE SAFETY. Today it is not only a matter of flying status but can we even meet the physical demands of flying and life itself? A great deal of research has been completed over the past 10 years which conclusively shows that heart disease is the number one killer in the United States today. In fact, Dr. Castelli, former director of laboratories in the Framingham Heart Program states their findings show we have an epidemic (6). The results of the Framingham Study and other similar projects have caused some national concern as evidenced by the increasing number of articles in popular newstand magazines that deal with the topic. However, the problem is far from solved, and the Air Force is no exception. Studies at the USAF School of Aerospace Medicine indicate the cardiovascular fitness of the average aircrew member is comparable to that of other "healthy" American males. In addition, measurement of body fat in the same group of flyers showed it to be above the optimum level.

Will men in this condition be able physically to fly the exotic aircraft which our technology can produce in the late 1970's and 1980's? Further, since both of these measurements are good predictors of susceptibility to heart disease, there definitely is a need to be concerned about the Air Force member's knowledge of how to overcome the problem of cardiovascular insufficiency.

The purpose of this article is to review the factors related to heart disease and to emphasize the importance of cardiovascular fitness and weight control in preventing heart disease. Also, we will present a simple method to determine percent of body fat.

F. Vitale (6) has reviewed avail-

continued



able studies and provided the following list of major risk factors associated with heart attack. The number in parentheses indicated the increased numerical risk of a heart attack for each factor:

1. Lack of exercise (2 times).
2. High blood pressure (8 times).
3. High levels of cholesterol or other fatty deposits in the blood (3—6 times).
4. Overweight (2—3 times).
5. Smoking (3—6 times).
6. Diabetes (2—4 times).

Perhaps the most alarming fact is that any combination of three of these factors *increases* the chances of heart attack up to *30 times.*

Dr. Loring Brock, Director of Cardiac Rehabilitation of the Spaulding Rehabilitation Center in Denver, Colorado, recently reviewed data collected in their work and emphasized that high cholesterol levels, smoking, and high blood pressure were the three major factors contributing to heart disease. He added that exercise is extremely important in cardiac rehabilitation and that 80% of their patients showed a 25-50% improvement following activity programs. Fletcher and Cantwell (1) discuss the problem in their book, *Exercise in the Management of Coronary Heart Disease,* and they state research shows exercise has a positive effect on the coronary risk factors of blood lipids (fats), systolic and diastolic blood pressure, and body weight.

The amount of exercise necessary to preclude the onset of heart disease varies with the type of activity; although as a general rule, 20-30 minutes of continuous work at a heart rate of 140-150, three times per week, has been found to be sufficient. The Air Force Aerobics Program (AFP 50-56) provides an excellent means of determining weekly exercise requirements for various activities.

It is very important to remember that the annual 1½-mile run is only the evaluation portion of the aerobics program, and the real value lies in the point system for prescription of weekly activity. A word of advice at this point—when you exercise, check your heart rate.* You may not be working hard enough to reach this 140-150 level. This is particularly true if you use a game like tennis or stationary running for your weekly exercise. You may be burning up the calories yet not conditioning your heart. Also, be aware of the fact that even though Category II is considered passing for Air Force personnel, any level below Category IV equates to a maximal oxygen consumption below the desired level—or in layman's terms, if you are not at this level then your exercise program is not doing the job. (Maximal oxygen consumption is a laboratory test that provides the best index of an individual's cardiovascular fitness (5).) Here is where the self medication comes in. When the annual aerobics testing program rolls around, do not simply count it as another square filled but use it as a means of estimating your present cardiovascular fitness. If it is not in Category IV, prescribe more vigorous activity!

The major coronary risk factors of high cholesterol levels, high blood pressure, and excess body weight are all very much interrelated. There is no doubt that there is a higher incidence of high blood pressure in people who are overweight. Likewise, blood cholesterol levels seem to be closely related to the amount of body fat. At this point it should be stressed that the percent of body fat is a much more important measure than simple body weight. Mayer (4) has shown that Air Force personnel categorized as normal on insurance height weight tables were actually obese when percent body fat was measured. On the other hand, body fat calculations indicated that some members identified as overweight actually fell in the normal range.

Since the amount of body fat is a good indicator of blood cholesterol levels, it seems imperative that we discuss the meaning and measurement of body fat in a little more detail. A body fat value states what portion of a person's total weight is fat. The average level for young men is 15%, while 21% is considered obese. The best measure-

*It is important to count the pulse immediately after stopping the exercise. Find your pulse within one second then count for 10 seconds and multifly by 6, since heart rate fall off occurs very rapidly.



ments of fat are obtained by hydrostatic weighing or dye dilution analysis; however, percentages can be estimated from skin folds or various body dimensions.

Wright and Wilmore (7) have developed a simple test for estimation of body fat that we believe can be used by all Air Force personnel. The only values required are body weight and the circumference of the abdomen at the umbilicus level. Body fat estimation can be made by following these steps:

1. Obtain body weight in kilograms (lbs. x .454).

2. Obtain abdomen circumference in centimeters (inches x 2.54). A cloth tape measure should be used. The individual should be relaxed, neither pulling in nor pushing out the stomach. The tape measure must be kept horizontal and should not cause indentations in the skin.

3. The values are then placed in the Wright Wilmore Equation (7). LBW(Kg) = 40.99 + 1.0435 × Wt(Kg)—.6734 × abdomen circumference (cm).

4. When LBW (Lean body weight) is derived, subtract it from the total weight to get fat weight. Wt—LBW = Ft Wt.

5. Percent body fat is then equal to (Ft Wt ÷ Wt) × 100.

If your percent fat is greater than 20% you should be concerned about your weight and blood cholesterol levels. Actual cholesterol levels can be measured by medical personnel and are of course the best assessment of this factor. Cholesterol levels higher than 250 mg are generally considered critical while values less than 200 are desired. Blood pressure is measured routinely at most Air Force medical facilities. The concerned individual will ask to see if his blood pressure is within acceptable limits.

Any individual who is aware of the major heart disease risk factors, and who is genuinely concerned about their presence in his health status, can take specific positive actions to preclude the onset of a heart attack. An honest appraisal of one's cardiovascular fitness can be gained by means of the aerobics 1½-mile run test, or a more precise evaluation can be obtained in a cardio pulmonary laboratory. Blood cholesterol levels and blood pressure values can be determined in medical facilities. Percent fat is a better indicator of obesity than total weight, and can be estimated by the Wright-Wilmore technique presented earlier. Smoking is obviously an individual decision.

As Air Force officers and, in many cases, pilots we have a responsibility to "improve the breed." Since technological changes are out of the question, we have to work with what we have and that means keeping the body well tuned. Physically, mentally and emotionally we must be able to respond to the demands of a technology that literally has given us the moon.

The fact that exercise impacts directly on blood cholesterol, high blood pressure, excess weight, and lack of physical activity, shows clearly its importance in preventing heart disease. Dr. Cooper described his program as a form of preventive medicine, and if applied properly it obviously serves that purpose. For individuals who have high blood cholesterol or are overweight, an increase in exercise may not be enough to cause desired weight changes (3). A sound diet low in cholesterol is generally indicated. However, diet combined with exercise is an excellent approach.

In summary, we suggest *all* Air Force personnel look at themselves closely in regard to coronary heart disease risk factors. If you are conscientious in your appraisal and you recognize any of these factors, you had better start right away to eliminate them with a little self prescribed exercise. Use your head, though. Excellent professional advice is as near as your Flight Surgeon. To fully enjoy your career *and* your retirement, a sound body is an absolute necessity. ★

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Anybody Know

"Because of lack of recent experience and proficiency, the pilot may have failed to adequately analyze the problem and elected to abandon the aircraft prematurely."



Every once in a while, people seem to get hung up on the obvious. They spend some emotion, much conversation and great quantities of time discussing problems which are no problem at all. The finding in a recent accident brings two of these issues firmly into focus. The first of these relates to current flying—practice, in other words, the second to the time of ejection—decision, conversationally speaking.

There have been numerous attempts to address both of these problems with some degree of objectivity. Many studies have suggested that the amount of current flying or the amount of experience really doesn't have much effect on accidents. Fortunately, there have been some others using somewhat more sophisticated methods and a larger data base which unequivocally show what everyone intuitively knows: *that experience increases proficiency and that current flying —practice—is essential if the fine skill required for successfully operating a high performance aircraft is to be maintained.*

That these findings resulted is not at all surprising. People do not come readily equipped with learning, nor, once it is acquired through the hard, disciplined process of repeated practice, is it retained unless efforts are made to do so.

Successfully flying an airplane, like the successful accomplishment of any other skilled activity, requires a great deal of very conscientious effort, as anyone who has proudly donned a pair of wings so well knows. Older members of this same group, having gained both proficiency and experience, also know that there were times in their past when they were better pilots, particularly if they were, at one time, flying more. In spite of this universal knowledge, there are still those who would insist that flying skill can be acquired with a minimum amount of exposure and that it can be maintained without repeated and very carefully controlled practice sessions, to assure that the finesse, once acquired, is maintained.

Rate:FlyingTime

When the questions of how much training is required, how much experience is desirable, and how much current flying, or practice, should be acquired are addressed, the issue becomes less clear. The same studies which so clearly demonstrated that current flying, or practice, is essential also show that, while there is a reduction in accident rate with added current flying, the reduction in rate never is as sharp as the increase in exposure. Simply stated, although the rate goes down, there are more accidents.

Now this presents the commander with a conundrum. Would he rather have more pilots with lesser proficiency or would he rather have

That

ANCHARD F. ZELLER, PhD
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fewer pilots with greater proficiency? Indications are that he cannot have both and therefore must settle for some intermediate point which reduces losses as much as possible while retaining a viable pilot force. While the amount of flying that will produce this varies among aircraft types and for pilots with varying levels of experience, even from pilot to pilot, a tentative point at which the accident curve seems to level out is at about 150 hours per year for fighter/interceptor aircraft, with less being required for aircraft that place fewer demands on the pilots. Needless to say, this time should be well scattered and should be utilized for training. To quote from an anonymous but erudite airman, "There is a great difference between 10 hours of training and 1 hour of training repeated 10 times."

While these general conclusions may serve as a basis for command allocation of flying time, from the standpoint of any one individual pilot, his goal should be *to get as much time in his unit aircraft as frequently as possible.* He should also strive *to make maximum use of that time* which he can acquire so that his proficiency increases and his accident potential is reduced to the minimum possible.

Now anybody knows that, but sometimes some people act as though they don't.



When To Eject

The next question to be considered is that of premature ejection. This bugaboo has been raised repeatedly. Some years ago a very well-known civilian writer, commenting in a well-read civilian magazine, wrote a blistering commentary on the inadequacy of the Air Force pilot's decision to eject, and the consequent hazard which was thus presented to the great populace at large. On the basis of that commentary, an analysis was initiated aimed specifically at evaluating the decision to eject. In contrast to some ejection studies, this one considered all accidents, whether the pilot had ejected or whether he had not. It evaluated the loss of pilots in both instances, and the damage and cost to the civilian community when all of the variables were considered. The summary of this evaluation stated, in part:

This evaluation shows quite clearly that the decision to eject is often directly dictated by the circumstances and requires minimum pilot decision.

Low level loss of control is not conducive to successful escape.

Ground difficulties seldom require it. When they do, adequate equipment is not available.

Loss of control at high altitude dictates that escape be attempted whether the loss of control is mechanical or pilot induced. Because such loss of

Anybody Knows That continued

When aircraft occupancy appears so untenable that the life or death decision to stay or escape must be made, it is the pilot in the cockpit who, in the limited time available, must make it.



control may not be recognized or because it develops so rapidly that a situation follows from which escape cannot be successfully made, the results are often fatal.

To preclude this result when control is lost, ejection should be initiated immediately. High altitude power loss with continued control is conducive to successful ejection or, if the emergency does not deteriorate further, to successful landing. When decisions must be made, most are well considered; a few are not. On the whole, however, Air Force accident experience indicates pilots are well trained and disciplined with an appreciation of their equipment as well as of the lives and property of the civilian community.

Examples of bad judgment have occurred and will continue to occur. The frequency of these unfortunate occurrences can be minimized by better escape equipment and more training in its use; by improved pilot training, particularly in the use of instruments; and by direct training in decision making. In the final analysis, however, when aircraft occupancy appears so untenable that the life or death decision to stay or escape must be made, it is the pilot in the cockpit who, in the limited time available, must make it. On the whole, he does this well.

Delay Factor

Subsequent studies on a case by case basis year by year have demonstrated that the biggest single factor in escape fatalities is delay on the part of the pilot in making this decision, even though all of the factors at hand indicate that the only thing that will be accomplished by delay is an increase in the probability of his death. There is always a conflict between a pilot's desire to save an airplane and the desire to save his life, once continued flight has become untenable. This is understandable. The pressure which commanders exert in encouraging their pilots to make sure before they abandon their aircraft is also understandable. In the final analysis, however, once the situation is perceived as lost, the only appropriate action is to activate the escape mechanism as expeditiously as possible in order to enhance survival.

Now anybody knows that, too.

Putting together this universal knowledge then, any pilot should get all the flying he can, maximize the training associated with his flying time, learn and practice his emergency procedures, and maintain complete control not only of the aircraft but also of the situation. In this way, he completes each flight that can be completed in the most successful fashion, and, in those instances where flight is no longer possible, he makes the appropriate decisions, implements the appropriate procedures, and maximizes his chances of survival while minimizing the losses which the Air Force is, at that point, inevitably going to experience.

And anybody knows that. ★

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TARGETRY & ASSOCIATED MYTHS

The success of a wide variety of tactical, defense, strategic and training missions depends in large measure on a relatively small but very necessary group of Air Force people who provide powered target support. Realistic and challenging target presentations must be created for both newly developed weapon systems and the test and evaluation of existing aircraft armament systems. Target drone units support these requirements as economically as possible using a limited number of resources. Powered target systems today consist mainly of the subsonic BQM-34A "Firebee" and supersonic "Firebee II," the PQM-102 "Pave Deuce," the CQM-10B "Bomarc," and development targets such as the High Altitude Supersonic Target (HAST).

In order for the target community to stay ahead of diverse and rapidly increasing requirements, target systems have become increasingly more sophisticated and expensive. The requirement for weapon effectiveness data with precise target versus shooter geometry dictates that targets must be able to very quickly enter the correct airspeed, G-loading, and bank angle configuration at high and low mission altitudes. In addition to these aerodynamic basics, targets must provide accurate infra-red (IR) and radar cross section presentations (real or simulated) for target threat simulation.

IR presentations for heat-seeking weapons must be able to simulate or provide various engine power settings, including afterburner. Simulation is provided on subscale targets by the use of wingtip mounted burner pods or flares; the full-scale PQM-102 of course affords the use of real afterburner. Radio frequency (RF) patterns and strengths for initial lock-on and radar missiles must include factors such as engine modulation and scintillation/glint effects. A variety of augmentation packages, waveguides, and reflective lenses is used to create desired RF effects. To complete the system evaluation loop, telemetric feedback of target and augmentation system performance and instrumentation for recording "scoring" data to evaluate weapon performance are necessary.

It is obvious that vehicles with this degree of complexity cannot be

continued



The Air Defense Weapons Center's celebrated Firebee nr 2722 flew 87 target missions before being fatally struck in 1973. The markings denote successful land or water recoveries.



The supersonic BQM-34F on its first launch from Tyndall AFB, Florida. The fuselage auxiliary fuel pod provides for longer presentation time and is jettisoned before supersonic flight.



A BQM-34A target lifts off for a mission on the White Sands Missile Range.



Composite photo of the PQM-102 target being recovered. Control commands are provided from atop the mobile ground station located near the runway.

operated on a one-shot, throwaway basis. In order to cost-effectively achieve the large weapon firing sample sizes needed for valid data analysis, "survivability" becomes the name of the game. Designed survivability and operational recovery success are inextricably related. The accident prevention program established for aircraft and missiles has been extended to provide a necessary means of implementing needed design and operational improvements for target systems as well.

The unique nature of the target mission has quite naturally been accompanied by its own set of goals, principles, and outlooks. It is interesting to note that accident prevention and investigation were not formally brought into the picture for target drones until the midsixties, 12 years after the Q-2C "training aid"—forerunner of the Ryan BQM-34A drone — began flying regular target missions. As a result of the growth and establishment of the target mission as an essential part of the operational force, some early concepts taken as "basic truths" have been overtaken by events and proven capabilities. Unfortunately some old ideas linger to the detriment of accident prevention today.

With scarce resources as a criterion, all of the functional elements contributing to the target effort—development, production, operations, maintenance, logistics, and safety must work toward the same end-game goal—to provide a sufficient number of correctly configured and performing targets at the lowest achieveable cost. The "myths" discussed in this article propagate attitudes which diminish the effectiveness of accident prevention programs and, therefore, must detract in some degree from the economical operation of targets.

MYTH nr 1: "They're expendable —we shoot them down anyway."

Mr. Robert Schwanhauser, who has long been active in drones as a "blue suiter" and now as a contrac-

tor executive, likes to relate the story of meeting the Air Force's BQM-34A contracting officer in 1954. His primary job was buying visual aids—projectors, charting materials and the like—and he *also bought drones.*

Our management style in the field was similarly casual. A lot of "random unprogrammed anomolies" occurred and could generally be accepted as inherent limitations of the system. Not that our target losses were so heavy; what we lost was the benefit of thorough investigation of inadvertent losses and the ability to act to prevent recurrence of the same problems. There were too few "lessons learned."

As accident reporting and investigation of drone losses took hold in the late 1960's, the idea of expendable targets began to erode. Moreover, as our units started to chalk up 20-30 flights per vehicle, we realized that recovery, not loss, was the norm. The goal of zero losses except for armament damage became realistically achievable.

"Expendable" resources are those which, when issued or functioned, can be considered as consumed and not reusable. Our recoverable targets no longer exhibit any relationship to this definition. BQM-34A SN 66-2722, pictured here, flew 87 missions from 1966 to 1973 and underwent a lot of bumper-straightening before retirement, showing what "recoverable" really means. In 1974, the Air Force flew 103 missions for each BQM-34A lost for accidental causes. This record is not characteristic of an expendable resource.

MYTH nr 2: "It's not worth the trouble and manhours involved in worrying about them and investigating accidents."

We are fortunate in having recently had the benefit of an impartial look at the question of investigation value. As the Navy's target program developed in magnitude, they asked an independent research firm to look at the Air Force's target accident investigation experience to determine if adoption of a similar program would be cost-effective. The BQM-34A Firebee, common to both services, was used as the test bed. Models were developed from the Air Force data bank to include costs and savings of corrective actions (one time and recurring), probabilities that the identified causes were accurate, probabilities of occurrence, and costs of the manhours and administration involved in investigating, staffing, reporting and follow-up. The study concluded that, if the Navy were to implement a formal USAF-style accident investigation program for a period of one year, the resultant net savings over the ensuing five-year period would be approximately $6 million. This independent analysis leaves no doubt as to the payoffs the Air Force has realized by investing the time necessary to prevent recurring target mishaps.

MYTH nr 3: "There's really no hazard with drones."

Few drone pilots have been seriously injured during even the most demanding missions! Let's face it—protection of people is the reason we have remotely controlled aircraft. Consequently, we tend to look at damage to and failure of our hardware as the driving force behind the safety effort. Even so, mishap files reveal a constant and serious "loss of control" potential. This hazard has always presented a threat to personnel and property in and around the flight corridor.

The MQM-13 "Mace" target program came to a close in 1974 after launching 165 birds and providing 132 successful target presentation missions. Mace targets, converted from tactical surface-to-surface weapons deployed overseas during the 1950s, were shot down 84 times over the Gulf of Mexico during the 5-year life of the program. Given the age and supportability problems associated with the system, this represented a highly successful use of otherwise obsolete air vehicles. It also provided two scenarios of the hazard of control loss.

In 1969, one target was lost over the horizon and could not be controlled or destroyed. It flew south from Florida and eventually fueled out after having flown *over* a well-known island in the Carribean! Over-the-horizon destruct with its own power source was incorporated and this never again occurred. But later in the program, with only a handful of Maces left to launch, a timer failed after liftoff and the drone flew gently back over the coastline, with remote control locked out, and eventually impacted, luckily, in an unpopulated wooded area on government property. The potential? Disastrous.

Our targets today are equipped with a myriad of redundant destructor recovery features which will operate without direct control and on internal backup power sources. Through constant surveillance, refinements continue to be made to prevent them from presenting a flight or impact hazard to anyone or anything. On the ground, as well as in the air, hazards must be continually recognized and controlled when dealing with powerful boost motors such as the 50,000 pound thrust Bomarc booster and landing and takeoff of the runway-launched PQM-102. Targets, like all aerospace systems, are not "inherently" dangerous or safe; the quality of their operation depends on the diligence and day-to-day hard work of the people who design, manage, maintain, and fly them.

Most of us who interface with aerial targets do so from a few miles distant with an eye on the scope and a finger on the trigger. A successful mission in this end-game situation confirms the value of past lessons learned. In no small measure, these payoffs germinate from the efforts of those who view mishaps and hazard identification as fertile roads to improvement. ★

OPS TOPICS

BIG WIND



Now that the E-4 is operational, the problem of jet blast is again popping up. Like the C-5, the E-4 produces an extremely high energy exhaust wake even at idle. ALSAFECOM 11/75 addresses this subject; all operations and maintenance people should be aware of the hazards.

FOD IN THE COCKPIT



The F-100 was nr 4 in an ACT mission. During a negative g maneuver the pilot noticed sparks coming from behind the headrest and the cockpit filled with smoke. After the pilot completed the proper emergency procedures and made a successful landing, the investigators found the ejection seat flight status pin lodged against the AC power control circuit breaker and the seat initiator hose. There was severe arcing and the initiator hose was burned through rendering the ejection seat inoperative. The pin had been stored in the map case during flight. However, since the map case lid was improperly fitted the latch did not engage. Under negative g the lid opened and the pin came out and lodged in the AC circuit breaker. Although part of the cause of this incident was noncompliance with a TCTO on the initiator hose, the seriousness of the loose map case lid is not lessened. Loose objects in the cockpit are a hazard. If the lid to a map case doesn't fit properly or if you lose something in the cockpit, write it up. You may be the one to fly that aircraft next.

CLEAR THE AREA!



An F-4 was damaged recently when a maintenance stand blew over striking the trailing edge flap. The stand blew over because an F-4 parked 175 ft behind the incident aircraft was scheduled for an engine run. The maintenance technicians saw the stand but did not think it was a hazard. Pilots, when you preflight do you look beyond the immediate area of your aircraft? It might save some embarrassment.

IT WORKED AS ADVERTISED



The O-2A FAC and his instructor were a bit surprised when the pilot released a flare and also fired a wp rocket. After they investigated the solution was obvious. The IP had left one of the rocket station selectors in fire. So when the trigger was depressed a rocket fired, as advertised.

F-4 NOTE



The crew was making a touch and go using full flaps. When the pilot raised the gear and flaps simultaneously a BLC light came on. There was no malfunction. Under the conditions described, there is a drain on the hydraulic system which can cause the flaps to become unsymmetrical and illuminate the BLC light without a BLC malfunction. The dash one does not address this problem and a change is being processed.

OPS TOPICS

HIGH, HOT, LONG



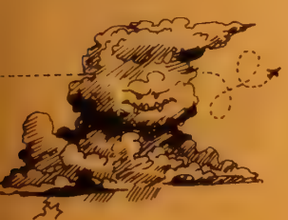
A C-141 was diverted to an eastern Air Force base. The available runway was 7000 feet long. At 1¾ miles the aircraft was so far above glide path that the controller advised him to go around if the runway was not in sight. The aircraft landed 2500 to 3000 feet down the runway and finally stopped 287 feet past the end of the runway in the grass. The computed no wind landing distance, since the runway was wet and two thrust reversers were inoperative, was 4600 feet. But since there was a tailwind the landing distance exceeded the runway available. There was also a 9000 foot runway which could have been used.

LOW FLOW



A T-39 was scheduled for an FCF for an engine change. The aircraft was at FL 290 and 170 kts when the pilot attempted an airstart check of nr 1 engine. At about 18 percent rpm he placed the airstart switch in the left hand position and moved the throttle to idle. There were no indications of a start, but the fire warning light illuminated. There were no malfunctions or procedural deviations. However, the combination of low density altitude and Delta T of +15 placed the aircraft at a density altitude of about 31,000 feet. This plus the marginal airflow through the engine resulted in puddled fuel and a fire.

THUNDERSTORMS ARE NOT FUN



Three trainer pilots learned that thunderstorms are not nice playmates. While at FL 450 in the cirrus one flew into a dissipating cell, encountered severe turbulence and sustained damage to the nose. A second aircraft lost an engine in severe turbulence while trying to avoid a cell at FL 450. The third aircraft was in the cirrus at FL 370 when it encountered lightning and lost airspeed indicator and cabin pressure as a result of a lightning strike. You can't win in a contest with a thunderstorm.

A CAREFUL PREFLIGHT IS A MUST IN THE DARK

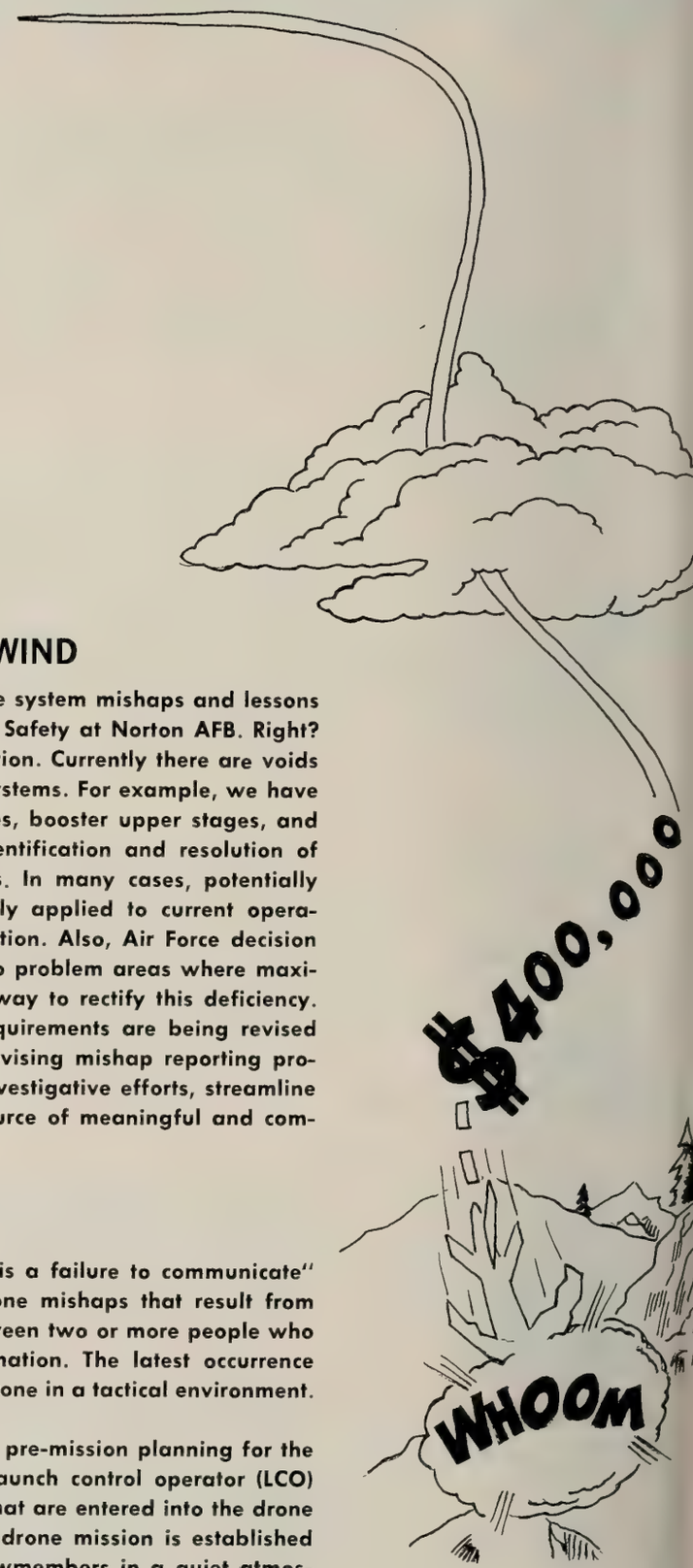


The B-52 had an antiskid failure and a blown tire on a dry runway. The investigation showed that the antiskid cover had been dented which caused the retaining bolt to damage the antiskid detector. The dent was caused by some heavy object—possibly a chock. The pilot did check the cover on preflight but did not see the dent, probably due to darkness. ★

SQUADRON REUNION

The 409 All Weather Fighter Squadron, Canadian Forces Base Comox, is planning a reunion to celebrate 25 years of active service. All ex-members of 409 Squadron are encouraged to contact Major A. J. Nichols for further information. His address is: Squadron Colours Coordinator, 409 AW(F) SQN, CFB Comox, Lazo B.C.





CHANGES IN THE WIND

If you need any facts about Air Force missile/space system mishaps and lessons learned, just contact the Directorate of Aerospace Safety at Norton AFB. Right? Well, not entirely, but we are heading in that direction. Currently there are voids in the data bank for strategic missiles and space systems. For example, we have little information on mishaps involving R&D missiles, booster upper stages, and operational satellites. This deficiency limits the identification and resolution of recurring problems associated with these resources. In many cases, potentially valuable mishap experience is not being effectively applied to current operational systems or to future weapons system generation. Also, Air Force decision makers are hampered in allocating scarce dollars to problem areas where maximum payoffs are possible. An effort is now underway to rectify this deficiency. AFR 127-4 accident investigation and reporting requirements are being revised to meet Air Force needs. This effort is aimed at devising mishap reporting procedures that will make maximum use of existing investigative efforts, streamline reporting procedures, and provide a centralized source of meaningful and comprehensive missile accident experience.

SPEAK TO ME

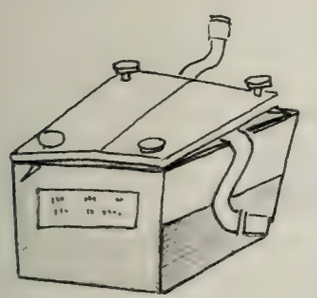
Once again the phrase, "What we have here is a failure to communicate" rings a familiar bell. Each year we experience drone mishaps that result from nothing more than unsuccessful communication between two or more people who depend on each other for mission essential information. The latest occurrence involved the short-lived flight of a reconnaissance drone in a tactical environment.

During this type of mission, it is routine during pre-mission planning for the airborne remote control operator (ARCO) and the launch control operator (LCO) to carefully coordinate the computer update points that are entered into the drone programmer. The pre-mission planning phase of a drone mission is established so that critical items can be discussed between crewmembers in a quiet atmosphere where time is not the critical constraint it becomes once the drone is launched and underway.

In this particular mishap, the ARCO and LCO did not coordinate the computer update points, which resulted in the drone flight profile getting out of sequence with the programmer. In their efforts to salvage the mission, time became their enemy causing other mistakes. A dial was misread by one crewmember and later the crew failed to notice the drone had descended to a dangerously low altitude where it struck a mountain—a $400,000-plus loss. The solution to this type of problem is tough. The launch, control and recovery of any target or reconnaissance drone is a precise operation, calling for thorough coordination between all crewmembers.

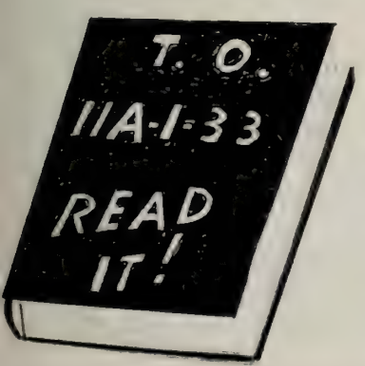
One suggestion is to review the current controller training program to insure that adequate emphasis is placed on coordination of specific responsibilities during all phases of the mission. Consideration should also be given to the pre-mission briefing itself. Do the crewmembers allow sufficient time to sit down and cover all the essential elements of the mission? What kind of environment are the pre-mission briefings conducted in? Is it a quiet comfortable location or is it a noisy, confusing area where it is difficult to recall your own name?

Prior to the flight, each crewmember should know exactly how the mission profile should appear as it develops, so that improper turns and altitude deviations will be quickly noted. During the mission, crewmembers must not assume that another crewmember sees a problem developing. He should take the initiative and be CERTAIN the other person is aware of a deviation when it occurs. After the mission, while the details are fresh in the minds of all crewmembers, a few minutes of self-critique will often reveal otherwise undetected "goofs" that, if continued, will inevitably lead to another mission failure. In summary, (1) before the mission—think and communicate, (2) during the mission—think and communicate, and (3) after the mission—think and communicate. This mini-checklist will save the Air Force many dollars and much personal embarrassment for all of us.



CABLE PACKAGING PROBLEMS RISE AGAIN

For some time, packaging procedures and containers for missile umbilical cables have been of concern. Last year due to the implementation of new procedures and improved shipping containers, there was a significant decrease in the number of damaged cables. However, the problem has reappeared. The primary contributors to cable damage were exposed nails or nails improperly driven into the container lid and apparent severe handling of the containers. Special emphasis is required by all applicable logistics related personnel in permanently solving this problem.

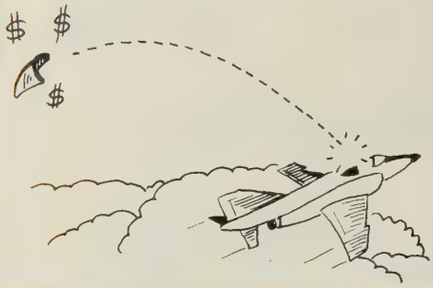


TECH ORDER CLARIFICATION

Apparently, questions have been raised at one of our drone units on the parking of BQM-34 and AQM-34 type drones in a hangar with the recovery system explosive components installed. The explosive hazards involved with these drones are identical to those of aircraft containing explosive components in the aircrew escape system. It was this type of analogy which led Ogden ALC to include the term "Pilotless Aircraft" in TO 11A-1-33, paragraphs 1 and 3b(3), Handling and Maintenance of Explosives Loaded Aircraft. Therefore, when dealing with problems concerning drones containing explosive components, dust off your copy of TO 11A-1-33. It should give you the answers. ★

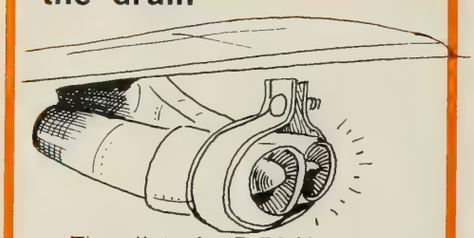
tech topics

$4,000 bushing



An F-4 had been airborne 10 minutes when the rear canopy suddenly departed. Investigation revealed that the canopy had not been jettisoned but had become unlocked in flight and the air load caused it to depart. Inspection of the hinges found a bushing missing from the inside of the right aft hinge point support assembly. The missing bushing allowed movement of the associated bolt assembly. The additional movement increased the stress on the shear rivet and caused it to fail prematurely due to fatigue. The failure of the right side shear rivet placed additional stress on the left side and caused the failure of the left shear rivet.

the drain



The pilot of a B-52-H was starting engines for takeoff. After nrs 7 and 8 engines were started a fuel leak was detected on nr 7. Troubleshooting found that when the fuel line was installed it was not clamped correctly so as to position the fuel line away from the engine turbine case.

shorted



The crew of a C-130A had just taken off from a northern base and during climbout the CPI deployed. The deploy switch guard was still safetied, but the deployed light was on and the beeper was heard on guard. Investigation revealed that the J-2 cannon plug on the mounting tray (MT-3712) was saturated with deicing fluid and it shorted giving the CPI a false deploy signal. The aircraft was deiced during preflight inspection for snow and ice removal and the CPI air foil, mounting tray, battery, latching mechanism, and associated wiring harness were saturated with deicing fluid.

loss of fluid



The F-4 had been airborne one hour when the pilot observed the utility hydraulic system pressure drop to zero PSI. Investigation after landing found the utility hydraulic pressure crossover line had failed because of chafing of the line against the PC II scavenge line quick disconnect elbow fitting, causing depletion of utility system fluid.

oil pump woe



On a routine training mission the B-52H crew encountered oil fluctuations on nr 3 engine. After landing, maintenance found accumulations of metal filings in the oil pump assembly housing (opah) and on the engine oil filter. The aircraft had recently been modified for quick start capability. When the cartridge start adapter was removed, an aluminum cover plate was installed over the flanged starter adapter housing. The splined starter adapter shaft at the center forward position of the opah was left in position and covered by the housing and cover plate. During engine operation the shaft backed out of normal position until it had only minimum contact with the female splines of the gear box. The splines of the shaft destroyed the seal at this point and the grinding action against the female splines produced the metal filings found in the oil. Other modified B-52s were checked but this was the only one found with the shaft left in place.

what a boob



The KC-135 had been airborne a little over an hour when the crew observed a slow decompression taking place. When cabin altitude went to 30,000 ft the crew descended to try and regain cabin pressurization. After 4½ hours flight the liquid oxygen was down to 1 to 1½ liters, so the crew switched to the gaseous oxygen system. About 30 minutes later the pilot began feeling woozy, noticed his vision was tunneling and that his instrument cross check was poor. He gave the aircraft to the copilot who made the approach and landing. Investigation revealed that the aircraft had pressurization problems on the previous flight and the corrective action was to remove and replace the cabin pressure controller and ops check in accordance with TO 1C-135-(K)A2-3. However, after the second pressurization malfunction, troubleshooting found that all four lines to the pressure controller had been improperly installed after the cabin pressure controller was replaced.

no caps



During takeoff roll, B-52H, the pilot's and copilot's indicated airspeed stopped increasing shortly after SI speed. After the aircraft became airborne, the command post was notified and maintenance assistance was obtained. After a brief discussion between flight crew, operations and maintenance personnel, it was confirmed that both indicated airspeed indicators were malfunctioning in the same manner. The flight crew was directed to check the pilot's and copilot's pitot test ports. Both test port caps were off and hanging from the retainer chains. The caps were installed and IAS moved to 250 KIAS. The pitot static system had maintenance performed on it but someone failed to put the system on a Red X in the 781.

checking the bottle



Two environmental specialists were inspecting a C-141 auxiliary power unit (APU) fire extinguisher system when the system activated. During test of the system, the electrically initiated squib was disconnected, the cargo fire handle was pulled, fire switch placed in the fire position and a voltage check was made at the squib disconnect plug. At this point the specialist at the APU squib location thought the test was completed and he reconnected the electrically initiated squib. The specialist at the engineer's panel performed his function check, and the system functioned as designed. The check was performed with one inexperienced specialist, and there was inadequate communication in a noisy area. Furthermore, the team didn't comply with tech data.



loose b-nut

The B-52H was on a navigation leg when the nr 7 engine began to surge and choo choo. With each throttle input attempt, engine roughness would increase. For engine preservation the engine was shut down. Troubleshooting upon landing found an improperly torqued B-nut had backed off the nose cowl anti ice valve surge bleed line, which allowed the line to loosen.

only one fan

During a ferry flight the pilot tried to reduce power for descent but throttle movement had no effect on nr 2 engine. The engine was shut down and a single engine landing made. Two out of three cotter pins from the gang bar in the throttle quadrant were missing, allowing the bar to become displaced from the throttle control. Research of records revealed that the last maintenance performed in the area was done during preparation of the aircraft for ferry flight.

short cord

A C-141 aircrew was preparing to start engines at a Navy base. While running the before engine start check list, a civilian transient alert person removed the external power cart from the area. One thing he failed to do was to make sure that the electrical power cord was unplugged from the aircraft receptacle. If the transient personnel are not familiar with equipment, they should ask the flight crew for advice.

two tries

The T-39 pilot had just started his takeoff roll when the nr 1 fire warning light illuminated. The takeoff was aborted. A second takeoff was attempted after maintenance personnel repaired a loose wire in the fire warning system. During the roll the fire warning light illuminated again. Another abort. Investigation revealed that the nr 1 tail pipe had been removed and replaced because of a crack. During installation the alignment indices had not been properly matched, allowing hot exhaust gases to flow through the space and outside the tail pipe area.

the bind

A pilot flying a T-39 was preparing to land when he was directed to make a go-around. During gear retraction, hydraulic pressure dropped to zero. The emergency release handle was used to extend the gear. At touchdown the hydraulic pressure returned to normal and operated normally until engine shutdown. Maintenance found the pin in the main landing gear door hydraulic manual dump valve linkage was installed incorrectly. The head of the pin was on top of the linkage rather than on the bottom. The end of the pin on the bottom of the linkage struck a screw head on the main landing gear door hydraulic manual control valve, restricting movement of the linkage and of the valve. The valve remained open allowing hydraulic system bypass and loss of pressure.

tech topics

hurry hurry

When an F-4 ground crew had completed their pre-engine run inspection, they found that the runup screen ball lock pin was missing. In order to complete the run, the operator decided to anchor the screen to the outboard hole on the intake using the ball lock pin attached to the rear cockpit jury strut. Engine start was normal. As rpm passed through 85 percent, the ground observer saw sparks coming from the tailpipe of nr 1 engine. Investigation revealed the jury strut was inside the engine intake during runup. A trip back to the maintenance section to get a good runup screen could have prevented this embarrassing situation.

not secured

Two B-52D aircraft have had minor damage because of doors not being installed correctly and coming off in flight. In one instance the door from the aft flare dispenser on the left stabilizer came off damaging the left elevator surface. In the other case dry bay access door nr 1 blew off, hitting the left outboard flap. To repair two aircraft because of improper installation of panels took 44 man-hours. Total cost $215.58.

missing entry

During pre-flight of a C-141, the engineer was checking the cargo doors. As the ramp reached the halfway up position, he heard a loud noise. Investigation revealed that the ads links had been removed for maintenance. However, no entry had been made in the AFTO 781A not to operate the cargo ramp. Removal of the ads links rendered the system unsafe to operate. The lack of AFTO 781A entry resulted in a semicircular crack in the aircraft frame which required 30 man-hours to repair.

incomplete run

The flight crew of the F-111 was performing an FCF. During the supersonic run, the left engine stalled and rolled back to 60 percent. The throttle was retarded to military but rpm could not be recovered. At this time the supersonic run was terminated. The engine was shut down, restarted, and operated normally for the return flight to base. Maintenance troubleshooting revealed the spike feedback cable connecting the spike assembly to spike controller had been improperly installed. The spike feedback cable became disconnected in flight, resulting in improper operation of the left spike and engine stall. ★

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ED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



Second Lieutenant
DANIEL C. STUTSMAN
Detachment 1, HQ 29th Air Base Group (ATC)
Fort Rucker, Alabama

On 29 January 1975, Lieutenant Daniel C. Stutsman was flying as a student pilot on a VFR solo training mission in a TH-55 single-engine helicopter. His scheduled mission profile involved executing multiple approaches and takeoffs to small unprepared landing sites surrounded by heavily wooded areas with trees 75-100 feet high. After approximately 30 minutes of flight, the aircraft yawed violently and there was a simultaneous reduction in sound level. He immediately recognized the indications of an engine failure, entered autorotation, and skillfully maneuvered the helicopter to his intended landing area. To avoid striking the trees and still make the landing zone, Lieutenant Stutsman had to bleed off some rotor rpm, but maintain enough rpm to cushion his landing at touchdown. Using techniques which normally are considered demanding of experienced helicopter pilots, Lieutenant Stutsman terminated the landing under adverse conditions with minimum damage to the helicopter. The exceptional airmanship and high degree of air discipline on Lieutenant Stutsman's part in handling this emergency prevented a possible loss of life, saved a valuable aircraft, and reflect great credit upon himself and the United States Air Force. WELL DONE! ★

AIR FORCE GETS LIFELINE



The Air Force has completed arrangements to purchase LIFELINE Magazi from the Navy. LIFELINE is the bi-monthly Navy safety journal dedicated all areas of ground and industrial safety. The arrangement will be similar that for DRIVER Magazine. The Navy will continue to publish LIFELINE w the Air Force sharing in the production cost. Units can procure LIFELI through their base Publications Distribution Office.

LOOK FOR IT SOON



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UNITED STATES AIR FORCE DECEMBER 1975

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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DECEMBER 1975 AFRP 127-2 VOLUME 31 NUMBER 12

NDUSTRIAL
DILEMMA



MR. FRED BUDINGER, Directorate of Aerospace Safety

If you were obliged to pick up the tab covering the cost of industrial accidents on your base or installation, would you still be satisfied with the accident prevention program that is being conducted there? Probably not. A review of the data on Air Force industrial accidents would certainly indicate that some of our people seem unaware (or perhaps unconcerned) that the tab for industrial injuries alone is about 2 million dollars a year. Property damage costs annually amount to several times that figure.

Although the Air Force strength has decreased every year for the past five years, the number of industrial accidents has increased significantly each year. Why? Human error? Definitely, but not only on the part of the individual most directly involved. In the majority of the cases we can further trace the real cause to a breakdown in supervisory control.

We don't mean to imply that a supervisor must personally oversee every industrial operation. However, he does have a responsibility for assuring that all his people are aware of the known potential hazards in their work area. And he must have educated them on safe work practices to the extent that they can be expected to perform their job in a safe efficient manner.

On the other hand, when a supervisor is physically present and observes an employee performing an unsafe act, he is as much at fault as the erring worker if an accident occurs.

How many of the Air Force industrial accidents this year came about as the result of an unsafe act on the part of the individual involved? We asked our iron monster (the IBM 360 Computer) for an answer to that question.

Would you believe that in only 2% of all the industrial accidents did we find that no unsafe act had been identified? Again, the finger appears to be pointing directly at middle management — particularly the immediate supervisor for permitting a situation like this to exist.

An environment where the worker displays a flagrant disregard for observance of established safety practices, and the supervisor either condones or ignores the practice, is certainly not conducive to efficient mission accomplishment. In nine instances this year, that combination culminated in a fatal accident, and in our society the worker is not expendable. The answer as to how to correct the situation is very obvious. Safety is everybody's business—worker, supervisor and commander.

Don't be the weak link in the chain. ★



RAPID DECOMPRESSION

LT COL
CHARLES L. POCOCK, JR.
Directorate of Aerospace Safety

"What the hell was that?" "Rapid decompression!" "Oxygen masks on—100%—check in and rapid decompression checklist."

That should have taken you about 10 seconds to read, which is about one-third of your Time of Useful Consciousness (TUC) above 35,000 feet. When a rapid decompression occurs, if you have to ask what it is, chances are you might not live to find out unless you already have your nose hose on. Even after you get your mask on, the next few minutes may be the most important of your life.

Despite our best efforts, decom-

pressions occur with unpredictable regularity. They occur in all pressurized aircraft, both military and civilian. The results are usually very similar.

ANATOMY OF RAPID DECOMPRESSION

Decompressions occur due to one of two causes. *Failure of the pressurization system* to maintain desired cabin pressure differential. This is a relatively slow decompression (several seconds to several minutes depending on the failure mode and aircraft type). Occasionally there is something that can be done to restore the pressurization system —change air conditioning/pressurization pack—select alternate air source—use manual mode and so on. At any rate this is usually not a panic situation and a normal, high speed, rapid descent can be made. The second type is *structural failure of the pressure hull.* Such things as window/canopy failures, door failures, frame and skin failures and battle damage, fall in this category. The greatest problems here are the questionable integrity of the aircraft, and the extremely fast rate of depressurization (usually seconds). This is a more complicated case since there is very little the aircrew can do to correct the problem.

Regardless of the cause of the decompression, aircrew's and passengers' first action always is to get their oxygen masks on and the regulator on the proper setting. This sounds so elementary that it shouldn't require repeating; however, year after year between 10 and 20 percent of crew members and passengers experience some degree of hypoxia during decompressions. This experience is closely paralleled by commercial air carriers.

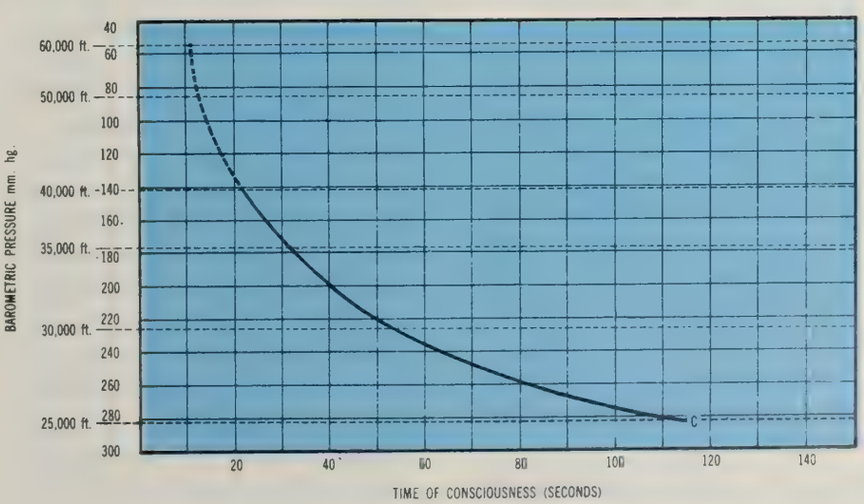
For crew members frequent decompression drills can reduce the time required to properly don oxygen equipment. When riding as a passenger, a mental drill and close attention to the oxygen briefing should be part of every flight. Passenger oxygen mask types and locations are different in many aircraft. Also, oxygen doesn't flow in many passenger systems until the hose is fully extended. Remember the human need for oxygen is greater than any other substance; you have to do it right the first time.

After you have your oxygen mask on, the next requirement is to descend to a safe altitude. Until it can be determined what caused the decompression and the extent of any structural damage, the best course is to unload the wings and tail by disconnecting the autopilot and relaxing control pressures. At high altitude the handling and unloading not only reduces structural loads but also helps to prevent a stall. After retarding the throttle(s) and entering the prescribed rapid descent profile for the aircraft, damage assessment should be started. If it can be determined that the aircraft is structurally sound, a high speed descent to a safe altitude can be made. If structural damage has occurred slow speeds and cautious use of drag devices is recommended.

Structural failure decompressions are very drafty, noisy and confusing affairs. In addition, sudden changes in pressure occasionally cause strange instrument readings. No trends are indicated in accident and incident reports, but generally after about one minute, as the pressures equalize, flight, engine, and system instruments again become reliable.

Once the PAN or MAYDAY message has been transmitted and the aircraft has descended to a safe altitude, considering terrain and fuel, thought should be given to landing. If there are injuries or the aircraft has structural damage an immediate landing at the nearest suitable airport should be made. If the airplane is OK and everyone on board seems to be all right then land at a military base that has a flight surgeon. He'll probably want to keep an eye on everyone for about 24 hours.

Most decompressions occur rapidly and unannounced. Aircrew reaction must be instinctive. The time to develop your rapid decompression plan is now. Your plan should be reviewed prior to each flight and continuously throughout each mission as the situations change. Whether you fly a single place or crew served aircraft, decompression drills are a good way to insure you can cope with an RD. ★





LEADERSHIP

Leadership-Management-Supervision. Many folks will argue that one is better than the other. Management often is discussed in terms cold and calculating. Supervision is addressed as enforcing those regulations 'cause somebody has to. But *Leadership,* ah a warm handshake, a gentle prod, a tailored flight suit that says "Follow Me." Few of us seek to be a supervisor; who of us wants to be called manager? All of us want to be remembered as "The Leader."

It's a big chunk to bite off to tell anyone about leadership. What are my credentials? Well, they are not much, mostly what I've seen. Oh, I've been in positions of leadership—element leader, flight leader, Operations Officer, Detachment Commander—and never lost an airplane and always made the mission. But on a one-for-one look, all that could have been just luck.

In the long run we have to have leadership no matter what we call it. Manager, Supervisor, or Leader. With it we can do almost anything. Without it we are reduced to luck, and anyone can tell you that luck cannot stand by itself—it must be modified, either good or bad.

I would like to cite some accidents we've had this year in which there was some plain bad luck. I'm going to give you some opinion also. I'm going to say that all of these 1975 case histories involved poor leadership, bad leadership, or no leadership.

• A fighter was launched on a mission with weather below that required. The pilot was relatively inexperienced and the instructor pilot had 308 hours total FP/IP. The pilot inadvertently entered IFR conditions and struck a group of



LT COL THOMAS E. BLEVINS
Directorate of Aerospace Safety

trees on top of a hill. The IP was preoccupied by WSO duties and failed to take corrective action. *Comment: The board found the IP at fault, but that's not my leadership point. The point here is, who decided to fly this mission? The authority to order a flight carries with it an absolute responsibility to supervise, manage, or otherwise lead others. Where was the guy who could have evaluated this mission, considered it important enough to meet the schedule, but then decided to wait for a better day?*

• Two bombers were launched on a mission for which neither crew had the experience or training required. During a night join-up, the wing pilot failed to maintain lateral and vertical separation, and collided with lead.

Comment: The bombers in this accident are notorious for poor external lighting. Yet somebody (leader) allowed crews with limited experience to attempt night formation.

• A trainer with two inexperienced pilots launched on a local proficiency sortie. They cancelled their IFR clearance and flew low level to the home of the copilot's relatives where a rolling maneuver was initiated with fuel remaining in the tip tanks. The aircraft struck the ground during the roll and both were killed.

Comment: In this accident, supervisors knew part of the flight profile clearly indicated a deviation from normal Air Force operating procedures, yet asked no questions. NOTE: I did not say "leaders" knew. . . .

• A trainer was flying a presolo contact training mission. The instructor had a total of 163 hours FP/IP time and was informally restricted to certain training missions. The student stalled the aircraft and the instructor took command but was unable to recover the aircraft. The student ejected successfully but the instructor ejected too late and was killed.

Comment: Many supervisors of this instructor knew he did not have the ability to perform as an instructor. One even took devious methods to keep him off the schedule. No leader made the tough decision, one that could have ruined the officer's career, yet saved his life.

• Two fighter pilots who were nonflight lead qualified were scheduled to fly together in a two-ship formation. The mission was inadequately briefed, and unauthorized aerobatic maneuvers, which were inappropriate for the experience level of the wingman, were performed resulting in a high "G" stall. The aircraft departed controlled flight and the pilot ejected.

Another flight of two fighters launched on a low-level navigation flight. After the low-level portion of the mission, the flight leader conducted unplanned, unauthorized and unbriefed aerobatics at low level over a lake. During the third pass, the wingman attempted a maneuver from which recovery was impossible. The aircraft crashed and the pilot was killed.

Comment: Both of these cases point to an atmosphere of laxity and poor discipline. The environment created by inadequate leadership, or no leadership, will I believe, lead to rabble.

• A fighter pilot with few hours in the aircraft was flying a difficult night radar bombing mission under conditions where procedures for night level radar delivery patterns were not clearly established. The pilot became spatially disoriented and flew into the ground.

Comment: A pilot, current in the aircraft (technically), yet with limited recent experience, was scheduled for one of the aircraft's most demanding missions.

Some time ago, an Air Force leader said, "You must match man with mission." Whether the flight is to be advanced training by an exceptional pilot or a simple training exercise by an inexperienced student, the person ordering the flight must be certain that the task to be performed is not beyond the capability of the individual involved. Good leadership could have prevented these crashes and the accompanying grief. LEADERSHIP DEMANDS DECISION. ★

THE IFC APPROACH

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

Recent queries indicate there may be a misunderstanding as to what pilot actions a controller expects when he gives the pilot descent instructions. This misunderstanding may have been motivated by the pilot's desire to use the most optimum altitudes and descent profiles in an effort to conserve fuel and thus save money. Many times these efforts have created problems within the air traffic control system.

Q. When I receive instructions from Air Traffic Control (ATC), must I comply immediately?

A. When ATC issues an instruction, pilots are expected to comply with its provisions upon receipt. ATC, in certain situations, will include the word "IMMEDIATELY" to impress the urgency of an imminent situation. In such cases, pilots should insure safe expeditious compliance with the instruction. (Ref. Airman's Information Manual, Part 1, Chapter 3, ATC Clearances/Separations.)

Q. What rate of descent should I use when cleared to descend from an enroute altitude?

A. ATC expects (1) if an altitude change of 1,000 feet or less is required, descend at a rate no less than 500 feet per minute; or (2) if an altitude change of more than 1,000 feet is required, the descent should be made as rapidly as practicable to 1,000 feet above the assigned altitude and then attempt to descend at a rate of no less than 500 feet per minute until the assigned altitude is reached. One technique that may be used is to compute the altitude to be lost, in thousands of feet, and double it. That number will be the distance between the start descent point and level off point. For example, if you are cruising at FL350 and are cleared to cross the 25 DME fix at 10,000 feet, start descent at 75 DME (35 − 10 = 25 × 2 = 50 NM, 25 + 50 = 75 DME). When using this technique, initially establish a 5 degree pitch change to start descent and adjust your pitch during the descent to make 10,000 feet at 25 DME using the above computation method. That is, passing FL 250 you have 15,000 feet to lose, 25 − 15 = 10 × 2 = 20NM, 25 + 20 = 45 DME. If you are closer than 45 DME, increase rate of descent and if you're at say 55 DME, decrease rate of descent. A good rule of thumb you can use is to increase/decrease pitch one degree for each hundred feet per mile of vertical velocity correction needed.

Q. If I am cleared to descend "at pilot's discretion," what does ATC expect me to do?

A. The term "at pilot's discretion" means ATC has offered the pilot the option to start descent when he wishes. He is authorized to conduct the descent at any rate he wishes and to temporarily level off at any intermediate altitude. However, once he has vacated altitude, he may not return to that altitude. (Ref: FAA Handbook 7110.8D, Para 783.)

Q. When instructed to cross a particular fix at or above/below a specific altitude, what technique should be used?

A. The manner in which the descent is executed to comply with the crossing altitude restriction is, as stated in the preceding answer, "at pilot's discretion." Descend at any rate you wish but make the crossing altitude restriction. If you have a choice, avoid cruising long distances at low altitude and conserve that costly fuel.

The following examples and explanations are offered to further clarify any misunderstanding that may exist. (Ref: FAA Handbook 7110.8D, Para 783:)

CLEARANCE #1. "RAMA 01, DESCEND AND MAINTAIN SIX THOUSAND." The pilot is expected to commence descent upon receipt of the clearance, and to descend at the expected rates, specified above, until reaching the assigned altitude of 6,000 feet.

CLEARANCE #2. "POST 36, DESCEND AT PILOT'S DISCRETION, MAINTAIN SIX THOUSAND." The pilot is authorized to conduct the descent within the context of the prior explanation of "at pilot's discretion."

CLEARANCE #3. "PIFAX 80, CROSS XRAY VOR AT OR ABOVE FLIGHT LEVEL TWO FOUR ZERO, DESCEND AND MAINTAIN SIX THOUSAND." The pilot is authorized to conduct descent "at pilot's discretion," until reaching Xray VOR. He must comply with the clearance provision to cross the Xray VOR at or above FL240, and after passing Xray VOR he is expected to descend at the rates specified above until reaching the assigned altitude of 6,000 feet.

CLEARANCE #4. "RAMA 03, CROSS XRAY VOR AT SIX THOUSAND, MAINTAIN SIX THOUSAND." The pilot is authorized to conduct descent "at pilot's discretion," but he must comply with the clearance provision to cross the Xray VOR at 6,000 feet.

CLEARANCE #5. "POST 20, DESCEND IMMEDIATELY TO FLIGHT LEVEL TWO FOUR ZERO, CROSS XRAY VOR AT OR BELOW TEN THOUSAND, DESCEND AND MAINTAIN

SIX THOUSAND." The pilot is expected to expeditiously comply with the instruction to descend immediately to FL240. After reaching FL240, he is authorized to descend "at pilot's discretion" until reaching Xray VOR. He must comply with the clearance provision to cross Xray VOR at or below 10,000 feet. After Xray VOR the pilot is expected to descend at the rates specified above, until reaching 6,000 feet.

NOTE: A pilot, while operating on an unpublished route or while being radar vectored, may receive an approach clearance with the stipulation to cross a fix, facility, or point at or above a specified altitude. (Example: "Cross XRAY VOR at or above five thousand, cleared for VOR approach.") This clearance allows descent "at pilot's discretion" to the crossing altitude specified. In this case, the controller has assured you IFR obstacle clearance from the point at which the approach clearance is received, until you are established on a segment of the instrument approach procedure. If you are uncertain of the meaning of clearance, you should *immediately request clarification* from ATC.

This article marks the 11th consecutive year of publication of the "IFC Approach" in *Aerospace Safety*. We hope the articles provide timely information to you, the reader. If there are any subjects you would like to see in the future concerning instrument flying—let us know. Write to: USAFIFC/FS, Randolph AFB, TX, 78148 or call: AUTOVON 487-4276 or 4884. ★

SAFETY IN '76
MAKE IT HAPPEN

ACCIDENT FREE 24 YEARS



The 76th Military Airlift Squadron (MAS), Charleston AFB, SC, in September completed 600,000 hours and 24 years of flying without a single aircraft accident.

Lieutenant Colonel Donald Smith, 76th squadron commander, explained the attitude of the unit's members in upholding the tradition of outstanding safety. "When new people come into the 76th and learn of our never having a flying accident, they almost instantly become safety conscious.

"Everybody in the 76th thinks safety all the time and would hate to jeopardize the record that's been built up over such a long period. Safe flying has become a way of life for us in the 76th."

During the 24-year, accident-free period, the squadron flew the C-54, C-121, C-130E and C-141 aircraft.

In photo above Lt Col Smith receives plaque recognizing his squadron's accomplishment from Brigadier General Tedd L. Bishop, 437 MAW commander.



FOUR MILLION MILES OF SAFETY

RAF ALCONBURY, ENGLAND—First Lieutenants Glen Alexander (second from left) and Tom Potere (third from left) hit the jackpot for their squadron after completing the flight that marked 10,000 accident-free flying hours for the 1st Tactical Reconnaissance Squadron. At an average of 400 miles per hour, the aircrews flew a total of 4 million miles, 160 times the circumference of the earth without any accidents. The two pilots receive congratulations from Lt Col Len Andrews, 1st TRS commander, as Maj Bruce Smith displays the jackpot commemorating the flight. Colonel Andrews attributes the successful record to the professional attitude of the aircrews and maintenance personnel at RAF Alconbury. ★

THE RAIN FROM PLANES

CAPT ROBERT M. CARNES
1st TFW
Langley AFB, VA
Adapted from **TAC** ATTACK



Cockpit canopies are seldom inadvertently lost in flight. But many other items are lost with a frequency that indicates we can do a much better job of reducing this hazard.

Tactical aircraft are designed to drop or fire "objects" . . . but at specific targets. Our tactical weapons systems have performed well as bombing, gun, missile and rocket delivery platforms, but recently objects have been departing our aircraft that were never intended to be released during normal flight and over unauthorized targets. Wing tips, panels, practice bombs, canopies, multiple ejector racks (MERs), external fuel tanks, radomes, pylons and fairings have been falling from the sky at an increasing and alarming rate. Besides reflecting unfavorably on the professionalism of (USAF) aircrews and maintenance personnel, dropped objects are hazardous to the health of people and animals, not to mention the high possibility of property damage.

What causes dropped objects? PEOPLE DO! Most can be classed as materiel failure or maintenance personnel failure, and both are interrelated. Ever lose some hard earned coins through a hole in your pocket? Haven't we all? Your fault? Heck no, it was materiel failure of the cloth. Think about it . . . the hole was probably caused by fair wear and tear on the pockets by coins, keys, nail clippers, etc. Why didn't you notice the thin spot or small hole in the pocket



Damage to church was from an external fuel tank that was inadvertently dropped from a USAF aircraft several years ago. Property damage was extremely high; fortunately there were no injuries.

when it started? Well, you did, but like most of us, you put off fixing it or just forgot. You knew that one day you would get around to repairing that pocket. You trusted that it would last another day and preventive pocket maintenance really wasn't necessary . . . not yet anyway. A familiar story to most of us that tells part of a tale involving maintenance personnel, materiel failures and dropped objects.

Remember that worn fastener on the panel that we intended to replace—one day? There were 11 other good fasteners holding the panel in place—but that panel came off in flight! Investigation showed "materiel failure" as the cause; the saving grace for maintenance personnel. We now can feel assured that it was not our fault, right?

For those who like facts and figures, let's look at our record on dropped objects. In calendar year 1974 and the first six months of 1975, USAF aircraft lost 1757 objects in flight. Some were attributed to maintenance goofs. A few were aircrew related. A few more were classed as "other" which covers such things as depot maintenance, contractor maintenance, bird strikes, air turbulence, lightning strikes, and "undetermined" causes. Anyway you look at it, that is a large number of objects freely falling from the sky and many dollars and maintenance manhours to repair and investigate the cause. It also creates turbulence in the supervisory chain of command and usually ends up with the maintenance person being hassled.

What can we do to reduce the number of dropped objects? It is so simple that we tend to overlook the obvious. Four basic rules of maintenance goofs and materiel failures.

Rule Number One: Completely remove or open; completely install or close.



continued



This tank is just one of the many dropped objects. In 18-month period of 1974-75, USAF aircraft dropped 1757 items.

This means that all access plates, skin panels, inspection and maintenance doors, pylons, fuel tanks, racks, etc., should be completely removed or opened when the need arises. Replacement and closure should be complete, too. Do not, for **any** reason, partially replace a panel or door. When replacing or closing a panel, do it completely . . . put it back on in a final fashion with all proper length and numbers of fasteners and with proper torque. It is too easy to overlook or forget about that panel that is in place, but only held with a few fasteners. These become dropped objects.

Rule Number Two: Replace all worn or broken fasteners when they are discovered—don't wait.

It is easy to tell ourselves that panels are secure and will stay in place even though one, two or three fasteners are worn, broken, or missing. This is the tendency when panels have many fasteners. The aircraft technical order may even specify that certain panels may have a specific number and sequence of fasteners missing and still be safe. But what of those other fasteners that may be worn, cracked, fatigued or possibly the incorrect length . . . the ones you don't know about? Another object will soon be following the law of gravity!

Rule Number Three: When personnel errors are the cause of dropped objects, check technical order procedures/compliance adequacy of local directives/checklists, and quality of training.

Besides fasteners, what causes dropped objects? Improperly installed electrical wiring, mechanical linkages, a forgotten cotter pin, improperly torqued bolts, lack of safety wire, no in-process inspection where needed, and poor use of tech data—just to name a few. This is a management area as well as a personal challenge to each line worker. We each know when our performance is not of the highest quality. Supervisors should not try to treat each individual case and hope this will alleviate the problems. Look deeper! What is your quality of training, quality control, job knowledge and tech data usage? The answer may be surprising.

Rule Number Four: When around any aircraft, look for the unusual.

Each maintenance person, not just crew chiefs, should purposefully look at an aircraft with a curious eye. Such things as cracks in wing and stabilitor tips, worn or missing fasteners, delamination of surfaces, loose objects, and lack of safety wire are just a few items to look for. Normally, anything that looks missing or loose is just that. If you are not sure, ask someone who will know. Ask until you are certain you have found the correct answer. Our job is maintenance, both corrective and preventive. Find just one thing that could possibly prevent a dropped object and correct it. If you are a true professional, it will give you a sense of pride and accomplishment.

Nothing that has been said is new or a revolutionary method of preventing dropped objects. The four rules are just a logical way of thinking and performing aircraft maintenance. Professionalism is a way of thinking that leads to correct maintenance actions. In this earthly environment, we may not be able to defy Newton's law of gravity, but if each maintenance person insures that every aircraft that flies returns to the ramp intact, we've defied at least one law . . . Murphy's! ★

ARE YOU FIREPROOF?

If you carry a metal match as part of your survival equipment or weekend camping gear, make sure that it hasn't:

1. Powdered away.
2. Been subject to any hard knocks and been crumbled into smaller pieces.

What is a metal match? It is a rod of metal that is stroked by another piece of metal, knife blade, etc., that will readily produce a stream of sparks that will quickly ignite prepared tinder.

The metal is composed of ferrocerium, which in a powdered state is pyrophoric, meaning it is capable of spontaneously igniting when exposed to air. We have on record two cases of fires caused by metal matches that had powdered away and spontaneously ignited.

To prevent fires caused by this substance, take a look at your metal match. If it has been broken, or if it has crumbled to powder, replace it with a new one. Leave it in its sealed container until required for use, and stow it away in such a manner as to safeguard its physical state.

This is a good system of ignition that will work under most climatic conditions. We certainly don't want to see you campers throw them away, just be alert to the fact that if they are broken or crumbled, a fire risk is present —so replace them. We have no knowledge of the life of these matches so your inspection is the best safeguard.

USN Weekly Summary ★

THREE PROS

CAPT LEROY BARNIDGE, JR.
69th Bomb Squadron
Loring AFB, ME

Professionalism is one of the most over-worked words in our Air Force vocabulary. Everyone talks or writes about "professionalism," but it is a most difficult word to adequately define.

I don't pretend to have a better definition than anyone else but I do have an example which I think exemplifies the true meaning of the word.

Three B-52G crews from Loring AFB were participating in the unit's Operational Readiness Inspection (ORI). There were thunderstorms along the route which required radar to circumnavigate. Crew E-08 was preparing to enter the low-level navigation route when the radar failed. The aircraft commander decided to stay high and wait for one of the bombers climbing out of the low-level route to lead them back to base. They made contact with crew R-18, but R-18 had no radar either. So the two crews made contact with E-10, 100 miles ahead with a good radar. E-10 turned back and using techniques employed in air refueling rendezvous, brought the other two bombers into proper formation. Then all three flew safely to Loring for recovery.

The ORI is an extremely important mission to a bomber crew. I am sure the temptation to "press on" was strong for E-08. And every pilot and crewmember has that feeling (whether they admit it or not) that they should be able to "hack it" without outside help. But in this case E-08 and R-18 did not fall prey to these influences. Instead their maturity and, if you will, "professionalism" prevented an ill advised decision and is truly representative of the finest traditions of the USAF.

To these three crews Mark Hunter and the Staff of Aerospace Safety magazine extend congratulations on a job well done.—ed ★

CHALLENGE & RESPONSE

As a student pilot was making a climb check in a T-38 he noticed the cabin altitude of 12,500 feet with the aircraft passing 12,000 feet. He mentioned it to the IP in the back seat but received no response other than acknowledgement of the challenge and response checklist items.

The student pilot continued the climb until passing FL 260 where the IP began to notice the onset of pressure from his oxygen regulator. He then assumed control of the aircraft, found that the cabin altitude read 29,000 feet, and immediately began a descent to below 10,000 feet. The IP flew back to the base where he made an uneventful recovery.

Fortunately, neither crewmember suffered any ill effects. When questioned, the student pilot stated that he thought the IP had heard him mention the cabin pressure during the climb check but, since the IP did not respond, the student continued the climb. The IP could not hear the student clearly because of air conditioner noise and so was unaware of the problem.

Both the IP and the student had a hand in this incident—the student because he did not demand a response, and the IP because he didn't properly monitor the student's climb check. Both are now wiser. ★



RVR UPDATE

LT COL JAMES R. WATSON
HQ ARRS
Scott AFB, IL

Several recent changes have been made in the reporting of runway visual range (RVR) at USAF bases. The following is a brief summary of the current procedures used by weather stations to report RVR locally to air traffic control agencies and in longline teletype weather sequences. Further questions and requests for clarification should be addressed to local base weather personnel.

a. Use of the term "runway visibility (RVV)" has been discontinued in USAF weather reports. All distances along the active (in-use) runway are now expressed as runway visual range (RVR). This change eliminates the confusion of two separate terms for runway visual data.

b. RVR data are determined using a nominal one-minute mean of instrumentally (or visually) determined values. In addition, data are based on the current runway light setting (3, 4 or 5) in use at the time the RVR was determined. If runway lights are inoperative or not available, RVR values are based on visual contrast of other lights or markers along or near the runway.

c. At most USAF bases, RVR is reported in hundreds of feet; e.g., R09LVR40 indicates that the touchdown RVR for runway 09L is 4,000 feet. At bases with Category II ILS, both touchdown and rollout RVR values are provided locally; e.g., R15RVR10/06- indicates that, for runway 15R, the touchdown RVR is 1,000 feet and the rollout RVR is less than 600 feet. In longline teletype weather sequences in the U.S., only the touchdown RVR value (coded in feet) is reported; e.g., RVR40, RVR10, etc. In teletype sequences at overseas bases, RVR is reported in meters; e.g., R1830 indicates that RVR is 1,830 meters.

d. At those USAF bases where airfield minima are published only in miles, RVR is reported locally in statute miles (nautical miles at European bases), rather than in feet. (Statute miles are reported by means of fractions, whereas nautical miles are in tenths of a mile.) For example, R14VR3/4 indicates that the touchdown RVR for runway 14 is 3/4 statute mile, and R27VRO.5 indicates that the touchdown RVR for runway 27 is 0.5 nautical mile. (Care must be taken not to confuse RVR values reported in fractions of miles with RVR values coded in hundreds of feet.) Note that RVR values coded in miles are for local use only and are not transmitted on longline teletype.

e. The contraction "NO" is used in place of actual numerical values when RVR data are not available; e.g.; RVRNO, R09LVR10/NO. ★



RED HOT *HYDRAULICS*

LT COL ROBERT J. BRUN, Directorate of Aerospace Safety

Judging from operational decisions noted in recent C-135 incident reports, it would appear that some of our aircrews and aircrew supervisors do not classify a hydraulic leak as a serious in-flight deficiency. There may have been some influence from "Press On-Itis," for whatever reason, but the determination to continue the mission despite ever-increasing evidence of serious hydraulic system problems indicates a definite lack of appreciation for the destructive power of an in-flight hydraulic system breakup.

A case in point involved a hydraulic problem which surfaced prior to takeoff and was temporarily satisfied by reservicing. Shortly after the departure, the left system quantity began to fade. Without a positive indication as to the location of the leak, this might have been a good spot to seriously consider the possible consequences of continuing the mission. After 3 hours of flight the right pumps had to be isolated and before the flight was completed, the right system failed from slow, steady depletion of fluid. Emergency extension procedures were used to lower gear and flaps for the landing, which was accomplished without further problems, but all pumps and flex lines came out a charred well done. The leak originated in a hose on one system and a flap flow regulator on the other. We weren't so lucky with bad hoses in a previous C-135 experience.

Shortly after takeoff, a leak developed at a loose hydraulic line connection on nr 4 engine. The fine mist ignited and caused a mild explosion and an engine fire resulting in minor accident classification. The fire got off to a good start and could have been far more serious, as was the case with a commercial BAC-111.

A hydraulic leak in the tail cone area of the BAC-111 had saturated the acoustical insulation blanket with fluid. Later on a malfunctioning valve in the bleed air pressurization system allowed reverse flow of high temperature air from the engine to ignite the insulation. Drains and lightening cutouts in the vertical fin structure produced a chimney effect which intensified the fire and led to structural failure of the empennage. The aircraft nosed over and crashed with no survivors.

As illustrated in the airliner accident above, hydraulic fires often start in an area where there are no detection or suppression devices. This alone should dictate increased caution when dealing with hydraulic system problems and weigh heavily in favor of returning hydraulic leaks to maintenance while they're still red and juicy as opposed to black and sooty. ★

OPS TOPICS

ONCE AGAIN . . .
WITH FEELING



Quoted from a mishap report "Isolated thunderstorms were forecast in the area during the flying period." Approach control did not volunteer vectoring around heavy precipitation areas. The aircrew did not request vectoring. The aircrew did not recognize the cloud formation as a potential thunderstorm and flew into the storm. The aircraft was struck by lightning.

NO RADIO BUT . . .



The tower operators at a far eastern airbase were surprised when an F-4 made a high speed low approach (less than 500 feet) without radio or radar contact. Believing the aircraft to be a no-radio emergency, the tower crew initiated the proper emergency procedures and cleared the aircraft to land by light signal. The aircraft made two more approaches. The first, clean and high speed. The second, in landing configuration before it departed the pattern. Later during investigation the pilot stated that he had an intermittent radio and no Tacan and he needed to make the three passes to identify the field. The weather at the time was VFR with a scattered deck at 2500 feet. Nuff said!

IN THE CLEAR, BUT



The F-111 crew was briefed on thunderstorm activity before takeoff so they were very careful when they saw the line of thunderstorms ahead. But since they were in the clear and the radar showed at least 10 miles from any storm, they felt fairly safe. As they were climbing through 10,000 to 12,000 feet, the crew felt and heard about 4 seconds of precipitation against the aircraft. After they returned to base they found hail damage to slats, panels and other parts—120 man-hours and $10,000+ to repair.

START IT RIGHT



The RC-135 had an inflight problem and nr 4 engine was shut down. After landing, Maintenance asked the pilot to restart nr 4 engine. The pilot initiated the start and as the rpm reached 15 percent he saw that the start lever was in idle, not in cutoff. The pilot retarded the start lever to cutoff to abort the start. Shortly after this the crew chief detected a fire in nr 4 engine. After the fire department extinguished the fire, the investigation showed that having the start lever in idle allowed raw fuel to flow into the engine, then as the start lever was moved back through the start range to cutoff, it activated the engine igniters and caused the fire.

WET AND SLIPPERY



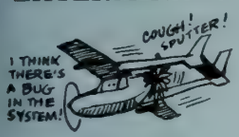
The C-135 was making a landing at a southern base. There were showers in the vicinity and tower reported a wet runway. The pilot planned for a maximum braking effort and everything was normal until about 120 knots on landing roll. Then the aircraft encountered heavy rain and standing water on the runway. The aircraft began to hydroplane and continued until deceleration through 90 knots. Then with approximately 3000 feet of runway remaining, braking effectiveness returned. The aircraft was stopped about 100 feet into the overrun. Hydroplaning conditions can develop very rapidly, particularly in association with the heavy rains of a thunderstorm. It pays to be prepared.

OPS TOPICS

CHECKLIST FOD

The A-7 pilot left his checklist on the intake duct and it was ingested by the engine. He was rather lucky because there was no damage to the engine this time.

CALL THE EXTERMINATOR



The O-2 was on a cross country mission when after about 10 minutes of flight the rear engine began running rough with a drop in fuel flow. The pilot landed at home base and maintenance troubleshooters found a moth (species unknown) clogging the air vent line to the right main tank fuel system.

WIND SHEAR STUDY

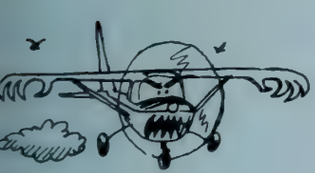


The FAA is beginning tests of wind shear measuring devices. This test is part of an expedited program to develop the capability to detect potentially hazardous wind shear conditions. The data collected from these sensors will be used to design automatic wind shear detectors that will be considered for possible operational use. The equipment currently under test transmits pulses of acoustic energy almost vertically. These pulses are scattered by wind or turbulence. Some are reflected back to the ground where they are picked up by microphones. The speed of the wind is measured by comparing the frequency of the original pulse with the frequencies of the returned pulse.

FAA ENROUTE CENTER AUTOMATION COMPLETE

The FAA has completed their program to update and computerize the Air Route Traffic Control Centers (ARTCC) in the CONUS. All 20 ARTCCs are now fully operational with a semi-automated radar data processing system. This is the system which provides flight data in alpha numeric characters directly on the radar display thereby eliminating the old manual flight data strips.

THE LITTLE ONES CAN GET YOU, TOO



Light plane flying can be dangerous. During one week there were four major accidents involving Air Force people and light planes. Three of the accidents resulted in fatalities. Every one of them was preventable. In two cases the plane crashed because the pilot was trying to maintain VFR in deteriorating weather. (One was observed flying 30 feet above the trees.) Another attempted to take off from a high altitude airfield with an overloaded aircraft. He stalled and crashed into the trees. In the fourth case the engine failed due to fuel starvation. The fuel tank was contaminated with cotton material. The contamination apparently occurred during the theft of fuel from the aircraft. Later the pilot did not accurately determine his fuel load prior to takeoff.

MIST IN THE COCKPIT



While climbing through 29,000 feet, the crew of a commercial airliner had to don oxygen masks and goggles when a vapor mist quickly filled the flight deck. An aerosol can of rain repellant had developed a rapid leak. It was placed in a plastic bag and secured. ★

WHO'S TO BLAME FOR THIS ACCIDENT?



LT COL HAROLD W. WESLEY
Directorate of Aerospace Safety

I suspect I have heard this single question asked more than any other one in my experience in the USAF safety business. My immediate reaction is to reply with an unequivocal and resounding "nobody," implying that we do not "blame" anybody for aircraft accidents. However, would I not be deluding myself and appear to be evading the question if I gave that reply? Do we assess "blame" in accident investigation? Of course we do! To attempt to convince others that we do not would constitute self-deception and hypocrisy.

To blame is "to hold accountable for" an error, omission, neglect or the like. This is exactly what we do through the process of investigating the accident. If we hope to achieve our objective of preventing accident recurrence by accurately identifying cause factors, we must continue in our efforts to determine who or what is responsible for each and every accident and to apply objective and impartial corrective action accordingly.

Am I saying "find out who the guilty so-and-so is and then impartially hang him?" Absolutely not! Punitive measures taken as a result of an accident investigation are definitely detrimental to the interests of free and and open disclosure of essential information in future investigations. Any personal or pecuniary liability arising from an accident should come about only as the result of a collateral investigation which is wholly separate and apart from the accident investigation.

For the most part, commanders are keenly aware of the separate and distinct purposes of the two investigations and most do not abuse the intended purpose of the accident investigation by using it as a basis for punitive actions. I say most do not—a few have and, in so doing, have done themselves and the USAF accident prevention program a distinct disservice.

To be held accountable for our actions and, often, for the actions of others is a part of our very existence. Accordingly, the potential for "blame" evolves. The society of which we are a part perpetuates this concept and most of us accept it, albeit grudgingly at times. Certainly those of you who are parents are accustomed to being held accountable for the actions of your children. Similarly, commanders and supervisors expect to be held accountable for the actions of subordinates. It seems, however, when "blame" with regard to an aircraft accident rears its ugly head, emotions run much deeper and much "wailing and gnashing of teeth" is heard. Indeed, it is apparent from our review and evaluation of accident reports that some accident investigation boards fail to identify the root causes of the accident if it involves citing human failings. Human nature? Perhaps. But clearly counter-productive to the intended



purpose of the accident investigation.

It is my opinion that much of the present feeling of stigma associated with implication in the cause of an aircraft accident developed in years past when the system required that we identify a "primary" cause of an accident. Acceptance of the fact that one is "the" cause of an accident, is certainly contrary to human instinct. Thus, the adrenaline begins to flow and the defense mechanisms are aroused to action when one is identified with an accident sequence. It is fortunate that some time ago we "discovered" what most of us had known intuitively all along—there is, in virtually all cases, a multipilicity of cause factors associated with an aircraft accident rather than a single or "primary" cause. This realization signalled the advent of the present "all-cause" system.

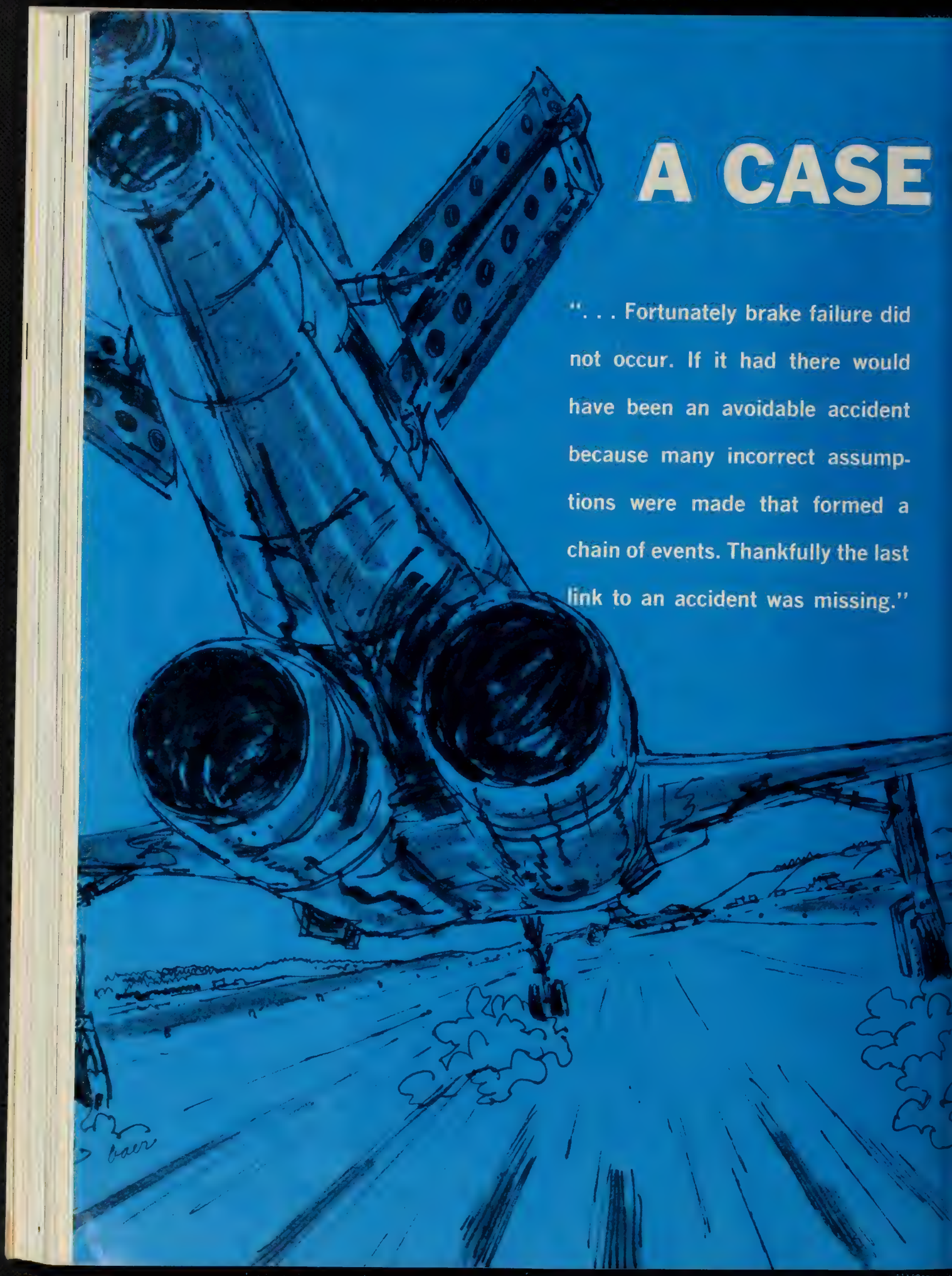
All-cause, although not a panacea, has been very beneficial in that it requires us to view the entire sequence of events which precipitated the accident as a unit and identify *all* the events in the sequence which were causal. This enables accident boards to view the accident in a broader perspective and pinpoint system deficiencies rather than simply zeroing in on individuals within the system.

For example, an aircraft commander may be cited for an error in judgment which contributed to the cause of an accident. However, quite often we find other factors such as supervisory deficiencies, lack of command guidance, tech data inadequacies, etc., which influenced that decision and, thus, are cause factors in the accident sequence. This, certainly, does not obviate the distasteful task of sometimes citing the individual's complicity but it does put his actions into proper perspective.

As each cause factor is weighted equally in the all-cause approach, boards and reviewing authorities can now formulate a much more comprehensive list of recommendations for corrective action.

As much as I would like to be able to say, "We will never again fix 'blame' in connection with an aircraft accident," I cannot. However, I believe that those who are subject to accountability will look at the system in a much more favorable light if they are aware of the underlying reasons for and are convinced of the objectivity of the accident investigation.

We focus on the actions, inactions, omissions, etc., of the individual only insofar as they relate to and enable us to identify deficiencies in the overall system and, in turn, to develop meaningful action to correct those deficiencies. We should not, and I believe we do not, point out individual errors for the arbitrary purpose of assessing "blame." ★



A CASE

". . . Fortunately brake failure did not occur. If it had there would have been an avoidable accident because many incorrect assumptions were made that formed a chain of events. Thankfully the last link to an accident was missing."

OF ASSUMPTIONS

It was a great day, the sun was shining brightly above the clouds and the FCF was going just beautifully. Below the thin layer of cloud at 8000' lay home base. There was no problem of having to do the FCF a great distance away and spend a lot of time getting from base to the working area and back. We planned to have lots of gas to spend some time in the pattern shooting approaches.

My WSO and I felt the aircraft was in good shape and our conversation and my thought went something like this: "Say, that radio is very quiet . . . haven't heard GCI say anything for a couple of minutes."

My WSO takes the opportunity to comment that GCI either talks too much or not at all, usually the latter if there is something important that should be said. He finishes, "They're probably out to coffee again."

We decide a radio check is in order but are unsuccessful in raising them. A call to center results in the same golden silence.

Our FCF is now complete and we are ready to RTB. The IFF is set to mode 3, code 7600 and we tune our data link receiver to GCI voice frequency and, "There they are, trying to call us just when we want them; things seem to be working as advertised."

We are identified by our IFF to standby and back to normal and we are cleared to go to terminal radar control for recovery. In no time at all the WSO has the data link on terminal frequency; our ARC 34 UHF radio is completely useless with no transmit or receive on guard or normal, but that shouldn't be any problem.

Terminal calls us and, if we read, we are to follow his heading and are cleared for an approach to home base by radar vectors. They identify us and we descend through the thin layer of cloud and we are set for a straight-in approach. At 20 miles out terminal advises that PAR is off the air and to expect radar vectors to a straight-in approach.

"Oh well, it's VFR."

The landing gear is lowered.

"It must be lunch time—everybody is coming back at the same time."

"Do you have the formation of four F-101's pitching out?"

"Roger."

A glide path is set up using VASI.

"The formation lead and nr 2 are down and clearing at the midfield cutoff, we should have just enough spacing on nr 4."

"Three and four are down."

Speed on final is right on . . . touchdown is good . . . chute is out . . . good chute . . . no wind to speak of at all today. The heat waves coming off the black asphalt are making it very difficult to see the formation ahead. Nose well up for aero-braking . . . can't see much of the runway but that's the way it has to be. . . . Now ease that nose gently to runway. Where is nr 4? Has he cleared to the dead side of the runway? No! He's dead ahead and almost stopped. . . . This is not the time for brake failure!!

Fortunately brake failure did not occur. If it had there would have been an avoidable accident because many incorrect assumptions were made that formed a chain of events. Thankfully the last link to an accident was missing.

My analysis and subsequent investigation revealed certain facts and lessons to be learned. First of all I should have gone around rather than attempt a landing, even if it might have caused confusion as to my intentions. I made assumptions that were not true. I wrongly assumed that terminal control had obtained final landing clearance.

Terminal control should have either obtained clearance or, once PAR went off the air, should have cleared me to a VFR overhead rather than a straight-in approach.

Tower did not know my exact position until I was over the threshold (when they gave a green light) and did not tell the formation that a NORDO was landing behind them.

Number four had made a very short landing roll, intending to take a cutoff taxiway abort halfway down the runway, but changed his mind when nr 3 went to the end of the runway, and was very slow in changing to the dead side of the runway.

I wrongly assumed that tower should be expecting a NORDO, since everyone else knew, and that they would advise pattern traffic.

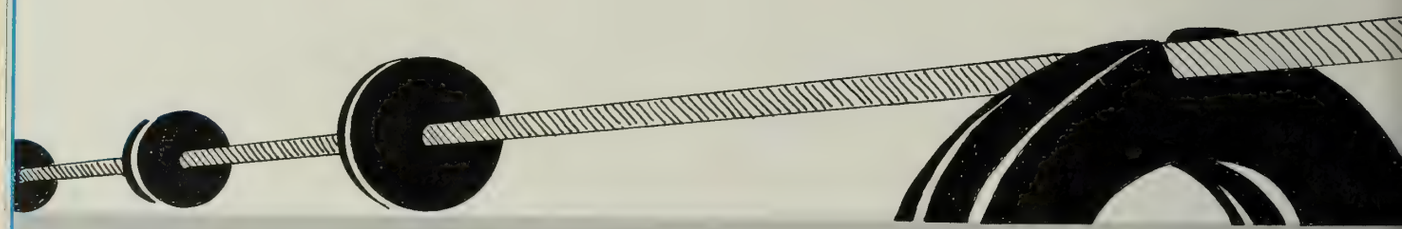
If I am ever placed in that situation again, if weather permits, I will follow VFR NORDO procedures unless I receive positive control and clearance to touchdown. One thing is for sure, "I learn't about flying from that!" *Anymouse.* ★





aircraft arresting gear

MR. ED JACOBSON
Kelly AFB, TX



Ideally, an aircraft arresting system (AAS) would have high energy capacity—low profile, fast/automatic recycle and all hardware retractable below the runway surface when not in use. Unfortunately, the state-of-the-art is not there yet. As Air Force requirements have changed from overrun "barrier" to down runway AAS, a high success rate has been achieved in arresting hook-equipped aircraft; however, you still don't get something for nothing.

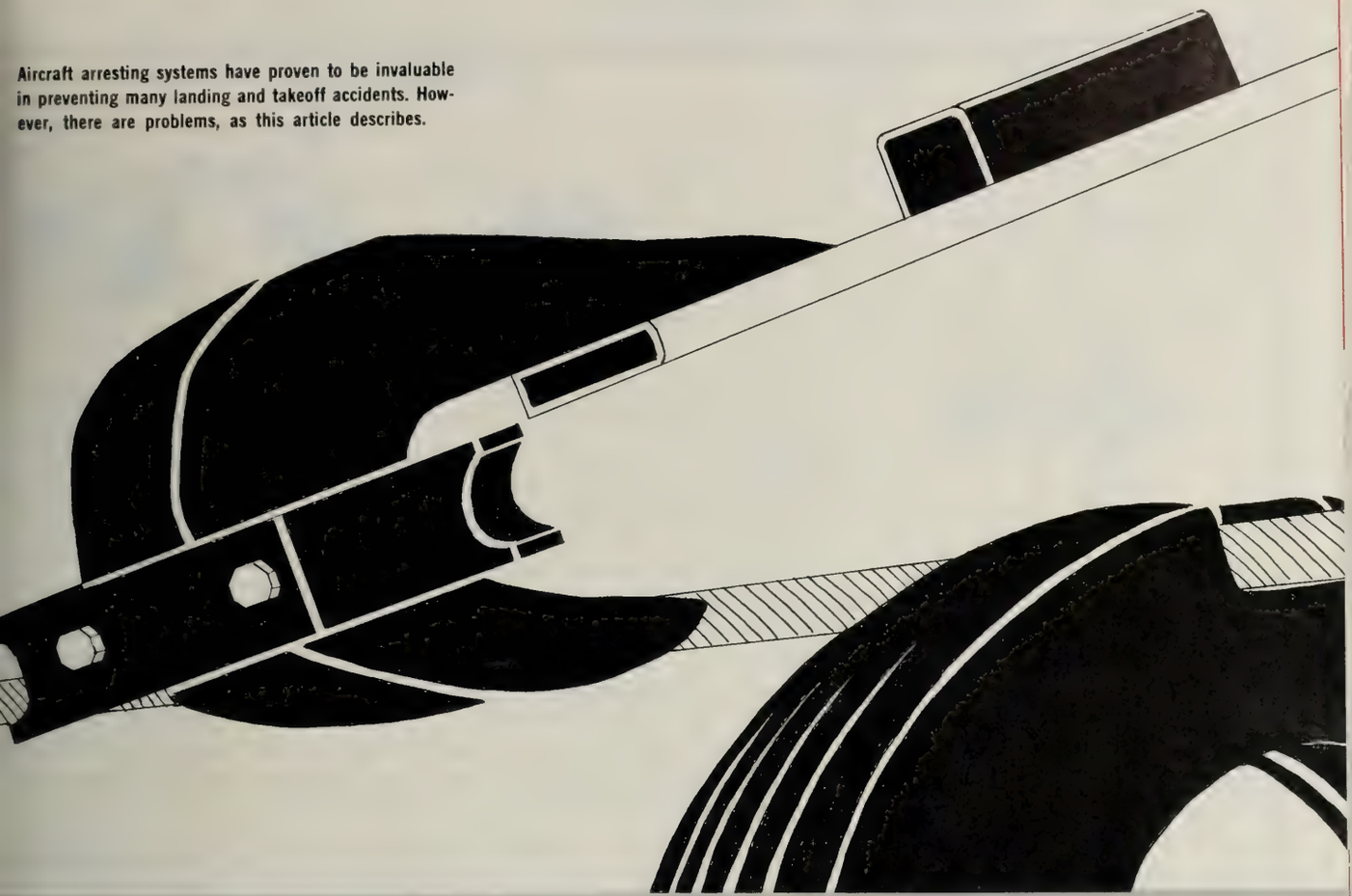
Periodically, an aircraft is brought to an abrupt unexpected stop by inadvertent engagement of an approach-end arrestor via a rebounding barrier cable deflected by a wingman or a phenomenal bounce from other sources. Damage to fairing doors, antennas, hook guards, etc., have also occurred periodically and will probably continue until a safe/economical method is developed to stow the cable when not in use.

Several methods have been used to support cables. Some of them are the "model 66" leaf spring support system, automotive tire sections, aircraft tire sections, "inflatable boots," polyurethane support rails, neoprene donuts, disc 6-inch diameter × ¾-inch thick and 7-inch diameter × 2-inch thick, and BAK-14 retractable pendant support systems. All of these have some good and some poor qualities.

Six-inch diameter × ¾-inch wide neoprene discs have been used predominantly because they offer a reliable/inexpensive support which gives the added benefit of being pliable enough that a direct hook-hit will result in the hook "scooping" the disc and also engaging the cable. The thin discs have proven not as effective on wide, high-crown runways, especially when the heavier, one and ¼-inch diameter cables are used. To overcome this "cable sag" problem, some AF users have installed a 7-inch diameter 2-inch thick (Navy) neoprene support disc. The Navy disc has done a really fine job as a cable support; however, several incidents of T-33/T-39 landing gear door damage have occurred from the seven-inch diameter two-inch thick disc.

We are experimenting with the 2-inch thick disc reduced in diameter to 5 and ¾ inches and if successful, will procure quantities of this type disc. Experimental quantities of BAK-14 retractable pendant support systems have been installed at selective sites to alleviate commercial carrier gripes from passing over "donut" supported cables by airline traffic. Limited quantities of

Aircraft arresting systems have proven to be invaluable in preventing many landing and takeoff accidents. However, there are problems, as this article describes.



BAK-14 systems have been dispersed to get a good geographical and climatic mix. The BAK-14 units appear to work well, except in extremely cold weather when rubber blocks become brittle and break. As expected, additional maintenance effort and costs are involved. It is anticipated that BAK-14 systems will be used only at joint use and privately-owned airfields.

Steel cables have always been the prime mover for AAS and overall do an exceptional job. Due to the dynamic limits of steel cable (approximately 190 knots), several efforts have been made to change materiel and cable construction to obtain a better cable. The current one-inch diameter cable is a "nonspin" 18 × 7, with independent wire rope center with a breaking strength of approximately 85,000 pounds. One and one-quarter inch cables currently being used contain a polypropelyne center but have a minimum breaking strength of 130,000 pounds. Although one and ¼-inch diameter cables are harder to retract and tension and are an interference fit in some hook shoes (F-105, etc.), the larger diameter cables do offer the higher breaking strength and more cross sectional area for resistance to tensile loads applied by hook arrestment after a bare-wheel rollover or other damage. The cables are optional; however, one and ¼-inch diameter cables should be seriously considered if most arrestments are of F-4 or heavier weight aircraft.

Several recent pendant cable failures have caused us to take a serious look at technical order cable replacement criteria and several changes are being implemented. Among the changes: all pendant cables will be replaced after engagements faster than 165 knots; the number of broken wires allowable in the length of the cable has been reduced from 20 to nine; cables will be replaced for a "necking down" condition that was not previously described.

Technical order changes are also being made reducing arrestor maximum speed limitations from 190 knots to 180 knots. This does not mean that the arresting gear capability is degraded in any way. What it means simply is that random cable failures occur at 190 knots and every effort should be made to reduce speed below that point prior to AAS engagement. On the bright side, we have successful engagements over 200 knots. Until something better is developed, we are forced to live with the speed and other restrictions of existing systems. ★

TECH TOPICS

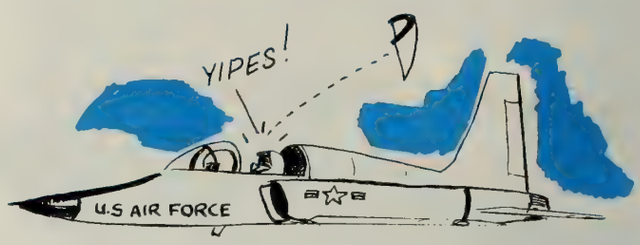
questions arise



There have been two recent explosive incidents involving the Koch Survival Kit. During postflight inspection on an F-4, the crew chief discovered the survival kit was unlocked. Life support personnel were sent for and they confirmed the actuator had been fired. The ground crew member had seen a small metal object with a lanyard attached between the Koch Kit and seat bucket while strapping the aircraft commander in the forward ejection seat for the first sortie of the day. Due to the position of the actuator, it looked normal so he didn't request life support personnel. The fact the actuator had been removed from the Kit indicates someone had fired the actuator and tried to hide the fact.

The second incident occurred during phase inspection. The Koch Survival Kit was left attached to the ejection seat and in the "auto" mode. During the inspection the Koch Kit was removed from the ejection seat, pulling the actuator lanyard, firing the explosive cartridge and opening the Kit. The questions arise: "How come the Kit was being removed when there wasn't a requirement for removal? Why were unqualified personnel removing the Kit?"

missing canopy



During preflight for a T-38 formation training mission the student pilot and crew chief together locked the rear canopy. The "not locked" warning light went out and a pressure buildup was noticed when the student closed his canopy. While the wingman was performing a cross under, the solo lead heard a muffled bang and felt a jolt. He advised his wingman of what had occurred. After the cross under was completed, the wingman noticed that Lead's rear canopy was open slightly and he asked if the canopy "not locked" light was on. The reply was negative. A few second later the canopy departed the aircraft. Investigation revealed the right rear canopy downlock mechanism had been improperly installed somewhere along the line. The shims were reversed, which allowed the downlock mechanism to slip in flight and the canopy to open slightly. The slipstream further opened the canopy causing it to depart the aircraft.

no pressure

A T-37 pilot was making touch and go landings. When the gear handle was raised, the gear failed to retract. Next the flap lever was raised and the flaps blew up to 5 percent. Hydraulic pressure was zero when checked. Maintenance troubleshooting found the thrust attenuator actuator barrel had been installed backwards, allowing the cap to be threaded improperly. The actuator failed at the threads resulting in loss of hydraulic pressure.

loss of fluid

During flight the loadmaster of the C-130 observed hydraulic fluid streaming from the trailing edge of the left wing. Investigation revealed an improperly torqued "B" nut in nr 3 dry bay on the flap brake line.

smooth flight



The F-4 pilot had just joined up in a flight of three and was thinking to himself, everything has sure gone smooth today, just hope it continues. They were making a slight left turn when things suddenly changed. Nr 1 engine started making an unusual noise followed by an rpm drop to 75 percent. The throttle was retarded to idle. All indications were normal. Inspection performed after landing found compressor rotor damage to nr 1 engine. A screw was missing from panel 9L. The thread imprints on stator blades matched threads on the screw missing from 9L.



The aircrew had all four engines running and was taxiing toward the active runway for takeoff. The next transmission over the radio was from the command post stating that the mission was cancelled for maintenance. The crew was really puzzled, for everything seemed normal. Back in the parking area the crew was informed that the nr 3 engine soap sample reported high iron. Inspection of the engine showed that the nr 1 bearing on that engine was "skating" in the housing.

panel problem



While preparing for descent, the F-111 pilot noticed a piece of metal protruding from the top part of the right wing above nr 6 pylon. The pilot looked back at the wing when they turned toward home base and the metal was missing. Postflight inspection found a portion of panel 6407 missing. Some of the forward attachment bolts had been improperly installed which caused the nut plate threads to strip. This allowed the bolts to vibrate loose and air loads to get under the leading edge of the panel and rip it from the aircraft.

long pull

The T-38 had been spotted on the trim pad and engine technicians were performing trim check. The nr 1 engine was 10 degrees C low on EGT at military power. The ground technician moved to the top of the fuselage to adjust the T-5 AMP. At this time he felt a tug on his ground communication cord. He started to pull on the cord as the engine compressor stalled. The stall was caused because the engine had sucked the ground cord into the intake. The ground cord was 100 feet rather than 50 feet in length as the technician thought.

worn ferrule

As the B-52 leveled off, the tail gunner reported fuel coming from the bottom of nr 4 engine strut. Nrs 7 and 8 engines were shut down and the fuel leak stopped. After landing inspection revealed the tube assembly from the fuel control to the pressurizing and dump drain was worn. The wear of the ferrule and "B" nut, through continued use, allowed the "B" nut to be moved to near the top of the ferrule when the "B" nut was torqued. Engine vibration and fuel pressure combined allowed the "B" nut to slip over the ferrule and the fuel line to disconnect.

chafing

The aircrew flying the HH-3E had been airborne just a few minutes when the copilot observed the primary pressure caution light on. The primary gauge also indicated pressure was zero. Investigation after landing revealed the primary hydraulic pressure hose between the primary pump and manifold had been chafed through by the nr 2 oil pump adjustment valve housing. Cause of chafing was incorrect clamping.

high pressure

As the pilot of the T-38 was passing through 10,000 feet he observed the cabin pressure at 8000 feet. After level off at 29,000 feet the cabin pressure was 27,000 feet. The pilot returned to base uneventfully. A clamp had been improperly installed allowing the hose in the air conditioner to come loose at the lower end between the duct water separator inlet and turbine.

straight pin



The T-38 pilot was advancing the throttles through the midburner range when the right engine chugged, stalled and rolled back. The pilot recovered the engine by retarding the throttle to idle. The throttle was then advanced slowly and as the rpm passed 97 percent, the engine flamed out. The engine flamed out because the inboard bleed valve clevis pin had become disconnected. This caused erratic bleed valve operation. The retaining cotter pin and clevis pin had been improperly installed.

excessive carbon

The B-52H was on a routine training mission for 3 hours when the nr 5 oil temperature light came on. The throttle was retarded to bring the temperature within limits. At this time the over temp light went out. However, 15 minutes later nr 5 oil pressure began fluctuating erratically. At this time both low oil pressure and oil temperature warning lights illuminated and engine was shut down. Inspection of the oil scavenge pump showed the pump had not been cleaned properly. This allowed excess carbon to build up internally in the pump and strainers.

hot



After five hours of flying, the pilot of a C-130B observed the nr 3 nacelle overheat light illuminating. The engine was shut down in accordance with the dash 1. The overheat light went out without the fire extinguisher agent having to be discharged.

Maintenance investigation revealed there were three gaskets leaking on the fourteenth stage bleed air manifold. The leaks were caused by improper installation.

wrong part

Forty-five minutes into what had been a routine training mission a T-37 pilot had to shut down nr 1 because of low oil pressure. When he got it on the ground, maintenance discovered that during preinstallation of the engine the wrong kind of quick disconnect had been installed on the oil line. That allowed the line to disconnect in flight with the subsequent loss of engine oil. This time the only loss was oil. Next time it could be an aircraft and perhaps the crew.

no follow up

The pilot, flying an F-4, had just taken off on FCF following PDM. As the gear handle was raised the gear indicators remained in transient position followed by the **master caution** and **check hydraulic** lights. The utility system indicated zero. The pilot declared an emergency and lowered the gear with the emergency pneumatic system. The aircraft was towed from the runway. The utility hydraulic line on the left main landing gear had ruptured from improper installation during PDM.

open circuit

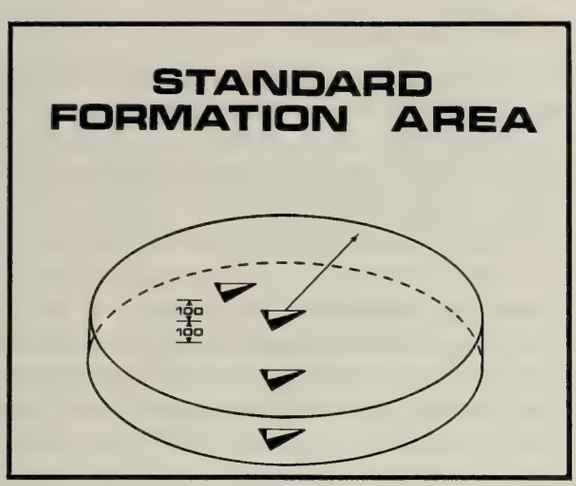
The flight crew of a B-52 had completed the prelanding checklist. Everything had gone smoothly during this flight and now all they needed would be a good landing. During the final part of the landing roll the nr 4 main tire failed. While troubleshooting the technicians discovered that the right forward antiskid control valve circuit breakers were open. The open circuit breakers prevented proper operation of antiskid on the three and four brakes. What they couldn't find out was why the circuit breakers were open.

no writing stick



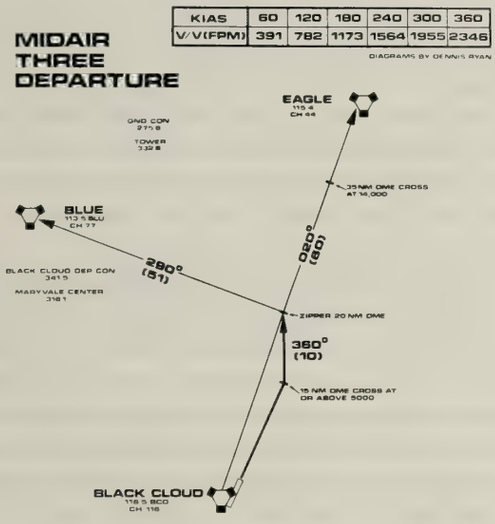
A maintenance crew had just started the post flight inspection on a B-52 when the technician performing the card item on the stabilizer reported to his supervisor that the RT stabilizer control access panel was missing. Sure enough, the panels had been removed for specialist work; however, the panel removal didn't get on to the 781A. The specialist performing work in the area did temporarily install the panels and made an entry in the AFTO 781A saying the panels were temporarily installed, but he didn't specify the location or nomenclature of the panels. The entry said left side; the missing panels were on the right side. Any time work is performed document it in the aircraft AFTO 781A. ★

the MID-AIR THREE DEPAR-TURE



KIAS	60	120	180	240	300	360
V/V(FPM)	391	782	1173	1564	1955	2346

DIAGRAMS BY DENNIS RYAN



CAPTAIN
RALPH C. GRAVLEE, JR.
Luke AFB, Arizona

"SPARROW 25, you are cleared to Kelly AFB via Midair Three Departure, Eagle transition, flight plan route. Climb and maintain 16,000 feet. Departure control frequency is 341.5, squawk 3510."

"SPARROW 25, Roger."

Sparrow 25 taxis and is cleared for takeoff.

"Black Cloud Departure, Sparrow 25 is airborne passing 2500 for 16,000."

"SPARROW 25 Roger, radar contact."

Sparrow 25 continues his climb and as he is passing 14,000 MSL, departure control calls, "SPARROW 25, say your altitude!"

"Black Cloud Departure, Sparrow 25, say ag. . . ."

No further transmissions were made as Sparrow 25 had impacted the center fuselage section of another aircraft at 15,000 MSL. Did you notice the mandatory crossing altitude of 14,000 feet between Zipper Intersection and Eagle VORTAC?

This is perhaps an overdramatization of a possible real-life situation, but even though the procedures are written very clearly, there are still misunderstandings about departure clearances and intermediate restrictions. Quoting the written word sometimes seems redundant, but in this case is apparently necessary to get the word out to everyone. AFM 51-37 says, "Adhere to the published SID route and altitude unless specifically instructed otherwise by the controlling agency."

It goes on to say "After establishing initial contact with departure control, some controllers will issue a clearance to climb to a specific altitude via a particular SID, usually the original clearance altitude and SID; however, this does not mean to disregard altitude restrictions published on the SID. To preclude misinterpretation, insure that the controller intends for you to climb, unresticted to your assigned altitude." In other words, when cleared to an altitude via a SID, *all altitude restrictions on the SID still apply unless specifically deleted.* A good unwritten rule here is Don't Assume Anything! When in doubt, ask!

Another problem that has reared its ugly head is that of "busting" altitude restrictions unintentionally, due to wingman positioning in some formations. FLIP defines a Standard Formation Flight as "A Formation Flight in which all aircraft are positioned within one mile horizontally and one hundred feet vertically from the lead aircraft." So, when ATC sees the flight lead on his scope, he expects that to be the center of a horizontal disc, one mile in radius and 200 feet thick.

Formation flights that are nonstandard may be conducted only when the flight leader has requested and Air Traffic Control has approved other than the Standard Formation dimension. Therefore, a formation flying a departure in trail, or in some tactical formations, must have approval *prior* to doing so. ATC can only provide IFR separation for a flight that is spread over 5000 feet of altitude if ATC knows about it!

Air Traffic Control and Standard Instrument Departures are there for our safety. A more professional use of these tools will provide a safer flying environment for everyone concerned.

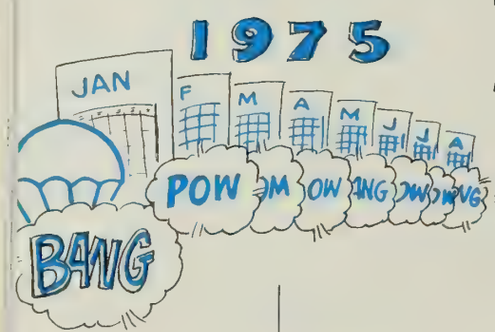
(This article was approved by USAFIFC—Ed.) ★

WEAPON SAFETY TOPICS

PROGRAM MANAGEMENT VISITS

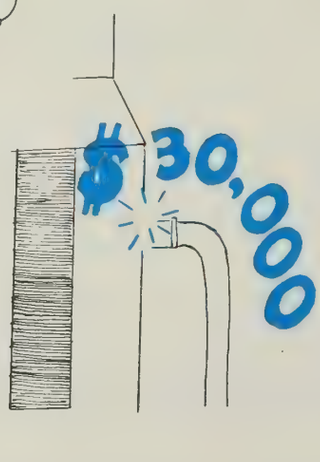


Another visitor! Where are they from? Why did they come? Will they leave another report to answer? These are sure to be some of the questions generated by the arrival of any higher headquarters personnel. Perhaps we can clear the air as far as the ICBM safety program management visits are concerned. There are three ICBM safety personnel assigned to the Directorate of Aerospace Safety, Air Force Inspection and Safety Center (AFISC), at Norton AFB, California. (AFISC is a field extension of the Air Force Inspector General located at the Pentagon.) We are experienced ICBM maintenance officers and our primary job is to develop, monitor, and implement the Air Force mishap prevention program for ICBMs. In order to effectively accomplish our job we conduct program management visits to all agencies connected with ICBMs. These agencies include all ICBM units as well as Headquarters SAC, AFLC, ATC, and AFSC, Chanute and Sheppard Technical Training Centers and Ogden Air Logistics Center. These visits are designed to gather current information on ICBM safety related problem areas and to directly communicate and emphasize the importance of the unit's part in the overall prevention program. We review the unit's total accident prevention program. This means not only do we discuss things with the Chief of Safety, but we also visit maintenance, operations, communications, and civil engineering agencies as well. Of prime importance are our trips to the launch facility, launch control facilities, and shop areas to see unit personnel at work. After all, safety cannot be divorced from maintenance and the other functions; therefore, accident prevention must be stressed by all personnel at every level, not by just the Chief of Safety. To keep the necessary communication lines open, we intentionally conduct our visits under an atmosphere of cooperation and assistance. In other words, we don't go to inspect but to assist and learn. Although we write a trip report upon our return to Norton, this is for our internal use within AFISC. Only if a serious deficiency is uncovered will external correspondence be generated. Hopefully, we have answered the questions. We strongly feel that program management visits are a viable part of the Air Force Accident Prevention Program.



MOD 7000 AUTOMATIC PARACHUTE ACTUATORS

The Model 7000 automatic parachute time delay actuator fired during movement of the parachute when the lanyard became entangled. This too should sound familiar, as it has been repeated 12 times during the first 8 months of 1975. Protect those lanyards at all times. Don't move the chute pack until you know the lanyard is free and secure.



HAVE A "WET ONE"

A recent wet LGM30F was the direct result of improper handling and inadequate inspection of a coolant quick disconnect (QD) on the missile G&C umbilical. The wet missile was caused by a ten-thousandths inch deep dent on a QD across 80 percent of the sealing surface and was visible to the naked eye. This slight dent caused at least $30,000 damage. These QDs are as critical in the prevention of coolant leakage as is the mating surface of the umbilical head. Each time the QDs are installed, an intensive inspection of the QD mating surface must be made. While the QDs are not mated, they must be carefully handled to preclude damage, and dust caps must be used. Let's prevent another "Wet One" by proper handling and inspection of QDs.

PERCENTAGES DO CATCH UP

Impulse cartridges (ejection cartridges to old timers) are small, cheap ($1.22 each), dependable (99.99 percent reliability at 95 percent confidence level) and simple devices used in great quantities throughout the Air Force. So simple and common are they that perhaps that in itself may be part of the problem. Personnel become so familiar with the cartridges that they often carry them around in tool boxes or pockets like they were shotgun shells, which indeed they do resemble.

The price is low because of the large quantities in which they are purchased, but they weren't always that cheap. The manufacturers went to great pains to develop and perfect an item that would be extremely reliable at strongly competitive prices. Components are built to close tolerances and are carefully assembled and sealed to assure watertight integrity.

But even at 99.99 percent reliability, the percentages can catch up with you. It did with tragic consequences recently. During a formation takeoff, an F-104 apparently ingested some FOD and had to abort. An attempt was made to jettison the tip tanks, but only one tank separated, resulting in aircraft instability and control problems. These control problems may have kept the pilot too busy to permit deployment of the drag chute and barrier hook. The aircraft impacted an elevated road shoulder with sufficient force to cause aircraft breakup and pilot fatality.

Now all persons who have been trained for, or have been on accident boards, and certainly all safety people will immediately point out that the impulse cartridge did not cause the accident. True, but it sure has to be considered as contributing to the severity of the results.

Indications were that the impulse cartridge primer fired but the propellant failed to ignite. Was this truly the one chance in 10,000 for failure? Did the percentages catch up? We may never know, but one thing we do know is that the percentages can be drastically changed by mishandling of the cartridge, such as carrying in tool boxes or pants pockets. One of the big causes of cartridge problems is overuse or misuse that results in breaking the moisture seal. Exposure to moisture such as rain or from altitude and temperature cycling which condenses moisture can contaminate the propellant to the point of no firing or slow firings.

There is no evidence that the impulse cartridge in the above referenced accident was defective from mishandling or moisture, but it presented a good opportunity to use it as an example of what could happen. Treat them with tender loving care because the job they perform is important and, as we have seen, can at times be eminently critical.



SAFETY CONFLICT

Safety officers—are you coordinating on unit directives that impact safety? A directive was recently published at a unit which, although it adequately covered the operational aspects of the task, directly conflicted with the basic principle of a sound safety practice. This directive required introduction of a spark producing device into an explosive facility and also created a significant maintenance impediment. Fortunately, this conflict was discovered by an alert safety officer prior to a mishap occurring and it underlines the necessity to become involved, as a reviewing/coordinating agency on those local directives that impact safety. Try writing an accident report on a .38 caliber weapon in the bottom of an ICBM launch tube if you need further convincing. ★





Re your July 75 Tech Topics, I really like the idea of highlighting the items caused by improper use of tech data. I notice that you didn't continue this technique in August and I'm sorry to see it.

I also had a few questions about some of the articles you didn't print in green. "Misaligned marks", "Plugged", "Wild Ride", "Double Jeopardy", and "Pressure Chamber" all smack of improper use of tech data. Why weren't they in green?

As Chief of Quality Control, tech data useage is a particular pet item of interest for me and my staff. Anything you can do to highlight problems resulting from its misuse will be much appreciated.

PETER S. MINER, Captain, USAF
Edwards AFB, CA

The color was just an idea of the editor's to attract attention. Apparently it did. No reason all items on tech data weren't included. Thanks for writing.—Ed.

A note of recognition should be given the 179 Tactical Fighter Group for having completed their 100th consecutive month of accident-free flying. This unit began its outstanding record while flying F-84s in 1967. In 1972, they transitioned to F-100s with only one-third of their officers completing their upgrade training at Tucson. The remaining pilots received home station checkouts from instructor pilots who themselves had only recently completed upgrade training in the F-100. Since the transition, the 179th has satisfactorily completed all 9th Air Force inspections and TAC ORIs. In addition, the maintenance section has continued to demonstrate its excellence by winning the 121 Tactical Fighter Wing's maintenance materiel effectiveness award five of the past seven years.

The safety record is even more commendable considering the flying conditions around Mansfield, Ohio, and the men who fly for the 164 Tactical Fighter Squadron. Of the 21 pilots who fly for the squadron, only one is a full-time technician. The other 20 men all have full-time civilian occupations. The list includes a dentist, a college administrator, a lawyer, an accountant, an insurance representative, three private pilots, a civil engineer, sales representatives, and a number of highly successful self-employed businessmen. Because of their outside responsibilities, these men bring with them the kind of professional integrity so necessary in flying tactical fighters on a part-time basis. The men fly in less than ideal weather with no approach radar and without precision approach equipment. (Note: though Mansfield has an ILS, the F-100D models do not.) Because of their limited turnover, these men have a feeling of pride in their unit rarely found outside combat squadrons. It is without question a proud group of professional fighter pilots who have recently been chosen over two other groups to be converted to C-130s in 1976.

JAMES F. ROBERTSON, Captain
Maxwell AFB, AL

Right on, Jim, that's certainly an outstanding achievement. I think the key elements expressed in your letter are outstanding aircrew performance and excellent maintenance. That combination produces the mission—safely.—Ed. ★

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Accident Prevention

Program.



First Lieutenant
MICHAEL D. LIVELY
1551st Flying Training Squadron
Hill AFB, Utah

On 24 March 1975, Lieutenant Lively departed Hill AFB in an H-3 on a training flight to practice hoist operations. The training area was a remote site at the 5000 foot level of the mountains along the west shore of the Great Salt Lake. The mission proceeded normally until the high hover phase of the first practice hoist recovery. With the aircraft in a 30 foot hover, the hoist operator cleared the student pilot for forward flight. As the student pilot applied collective to take off, the number two engine dropped to ground idle. Lieutenant Lively saw the engine instruments decreasing rapidly and immediately took control of the aircraft. He insured that the throttles were full forward. Rotor rpm was decreasing through 90 percent and the helicopter was descending into an area full of large boulders. The collective that had been applied by the student had reduced the rotor rpm to such a point that the aircraft was committed to a landing. Lieutenant Lively, with judicious use of collective, was able to maneuver the H-3 over a clear area with the remaining rotor rpm. At approximately two to three feet above the ground, full collective was applied to use the remaining rotor rpm to cushion the landing. The rpm at touchdown was approximately 60 percent. He safely landed the H-3 in a small clearing with no damage to the aircraft. Any erroneous cyclic stick inputs with this low rpm would have lead to main rotor blade-to-fuselage contact and probably injury to crewmembers and major damage to the helicopter. Investigation revealed that moisture in a pressure line to the fuel control had frozen, causing an erroneous input to the fuel control which drove the engine to ground idle rpm. Lieutenant Lively's expert judgment and superior airmanship prevented a serious aircraft accident. WELL DONE!


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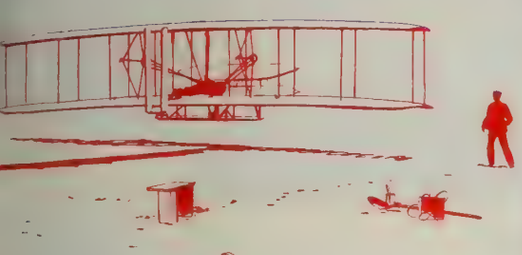
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THE MISSION - - - - - - SAFELY!

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JANUARY 1976 AFRP 127-2 VOLUME 32 NUMBER 1



a "coke"™ and a candy bar

LT COL DANER R. REIDER, USAF, MC
Directorate of Aerospace Safety

The fighter pilot's lunch. If you or your friends have had such a "meal" before an afternoon flight, then you are continuing the tradition of "press-on," "hack-it," and "get-on-with-it." You are also eating "empty calories," compromising your overall health, and increasing your chances of having a physiological incident.

From January 1971 to September 1975, 36 physiological incidents occurred in which missed meals or poor eating habits were contributory. These incidents involved 39 crew members, of whom 22 were student pilots. In many cases, the crew members adopted their poor habits because of dieting, lack of time, or previous life style. However, such poor nutrition is not unique to crew members or the Air Force. We are part of a society that is fast-moving, tense, anxious, and just plain "hyper." We spend millions of dollars on antacids and diet books, and relatively little on tasty, beneficial meals.

If you are a pencil-pusher, a fighter pilot, or a motor pool grease monkey, you still need certain essential vitamins, protein, carbohydrates, and fat every day. Ask your self the following questions:

- How often do I have coffee and a fat pill for breakfast?
- How many times do I have popcorn and beer for supper?
- Do I really need that pizza while watching TV?

These questions lose their humor when you consider that the author has found these and similar entries in the 72-hour history of crew members involved in physiological incidents. As a flight surgeon, I cannot state that poor nutrition is a direct cause of incidents, but can be confident in saying it definitely contributes.

Poor nutrition increases your susceptibility to the stresses of flight. Hypoxia, hyperventilation and fatigue are just some of the stresses which missed meals can exaggerate or aggravate. The combination of these stresses with night refueling in weather creates a very dangerous situation requiring more than skill to resolve. You may never find yourself in that predicament if you have taken the time for proper rest and nourishing meals.

"But, Doc, I'm gaining weight and can't eat all that food." Baloney! There are many excellent diets based on low calories and low cholesterol that won't strain your nerves, your pocketbook, or your wife. Your flight surgeon can give you the best advice on a diet which will provide for weight reduction AND necessary nutrition.

My recommendation for you and your friends is take the time to eat three square meals a day. You need everything going for you when you fly your check ride, take a five-level test, or give a briefing to the general. Don't jeopardize your chance for success with a fighter pilot's lunch. ★

NO DICE WITH ICE



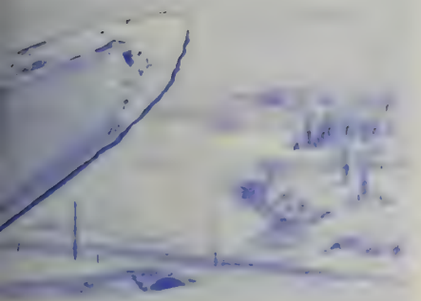
SQN LDR MARK PERRETT, RAAF
Directorate of Aerospace Safety

It is quite a relief to transition from summer to winter flight conditions, especially in those relatively dry areas of the United States. From October through May, the engines seem to gain new life, and the aircraft demonstrates a pleasantly surprising eagerness to fly. We quickly achieve cruising altitude. We've left behind the worries of the paper empire, the air is crisp, cool and clear—no more thunderstorms till next year! What clouds there are look just like the living room carpet—flat and smooth and comfortable—innocuous.

There are a thousand quotations associated with flying. One I like is "The expected rarely causes accidents—the unexpected invariably does." It is easy to slip into winter operations without conscious adjustment from summer techniques. So many accident reports, however, contain statements very similar to this. "I did not think much about it." A Sabreliner accident last winter exemplified that statement.

The flight was scheduled to a destination which was in the path of a cold front. Low ceilings, icing conditions, snow on the runway, snow flurries, 800 feet obscured, light to moderate icing up to 10,000 feet—all of these terms, among others, were mentioned in various forecasts received by the crew. A local USAF unit reported that they had suspended operations for the day in the face of these conditions. The crew decided to press on. They had planned a weekend off at the destination, and their wives were waiting at the airport to pick them up.

The pilot called approach control and requested a touch-and-go to test braking action, followed by a circling approach for a full stop. Following the touch-and-go, the aircraft turned right, the crew lost sight of the field and requested instructions for an ILS approach. The pilot's stated intention was a further





braking action check, and a diversion to his alternate, if a full stop could not be accomplished.

After touching down 1000 feet past the threshold (runway length 7000 feet), the aircraft ran along the ground for an estimated 2500-3000 feet, rotated and lifted off. It climbed to approximately 150 feet at an apparent low speed and in a high nose attitude. The right wing then dropped, and shortly afterward, the aircraft rolled inverted and disappeared from view. The five souls on board died in the crash.

The accident investigation determined that the cause of the accident was departure from controlled flight resulting from the effects of severe icing on aircraft performance. Prolonged operation of the aircraft in severe/moderate icing conditions was considered by an FAA technical icing report to have produced the following results:

- Minimum glaze ice build up would have exceeded a thickness of one inch on leading edge surfaces.
- Minimum weight increase—230 pounds.
- Minimum increase in stall speed—22 percent.
- Minimum increase in drag—48 percent.
- Minimum decrease in rate of climb at sea level—45 percent.
- The aircraft would have required a minimum runway length of 9500 feet under the existing conditions.

Modern aircraft design incorporates anti-icing systems vice the deicing systems of yesteryear. Modern aircraft, because of jet engine optimum performance characteristics, are not "expected" to operate for prolonged periods in icing conditions. Anti-icing systems are not perfect—there is a definite point beyond which they cannot cope with ambient icing conditions.

Air Force and command regulations are explicit regarding aircraft operations in icing conditions. They exist to close the gap between the capabilities of aircraft anti-icing systems and the severe meteorological phenomena which can be encountered in winter. These regulations must ultimately be applied by the operator—you. You must know the regulation as it applies to you and to your aircraft, and you must anticipate those flight conditions which are beyond the physical capabilities of your systems. Remember—"The expected rarely causes accidents." ★

Be Prepared!

SQN LDR MARK PERRETT
Royal Australian Air Force
Directorate of Aerospace Safety

A T-39 indulging in its usual summer bent of flirting with thunderstorms, climbed to FL410. Soon after leveling, moderate turbulence was encountered, and one engine flamed out. In an effort to remain clear of the storm, an immediate relight was attempted, but was unsuccessful. A relight was accomplished at FL 290.

Another T-39 flamed out under similar circumstances and descended to FL 290 for relight. At the first attempt a fire warning light illuminated. After further descent, the engine was successfully relit.

Other instances of unsuccessful relight have indicated that the upper altitude limit of the airstart envelope has been too high. TO 1T-39A-1S-11 (T-39 operational supplement No 11), distributed in October 1975, reduced the upper limit to FL 260. This amendment was designed to accommodate atmospheric variations from the standard. (Some of the attempted relights at FL 290 actually were at a density altitude of over 31,000 feet.)

These departures from the norm are worth commenting on:

- A hot relight was attempted at FL 410—compare with Caution on page 3-11 of TO-1T-39A-1.
- The airspeed was allowed to decrease below 180 knots IAS—compare with page 5-6 of TO 1T-39A-1.
- The engine was restarted after previous shutdown for fire warning light during attempted airstart — compare with page 3-12 "Normal Restart" TO 1T-39A-1.

Jet engine handling is simple when compared to the piston engine, but it does require some thought. High altitude handling is particularly important, and T-39 pilots, just like the boy scouts, should know how to light those fires efficiently. ★

The following narrative was part of a Well Done nomination. Since space on the Well Done page did not permit printing the full story, and because we considered it interesting enough for better coverage, we are offering it here. The Well Done feature is on the inside back cover.—Ed.



Departure from Torrejon AB, Spain, for McGuire AFG, NJ, was scheduled for 0700L for Capt James R. Polizzo and his crew.

Their aircraft, a C-141A, was loaded with nine pallets and three sets of triple airline type seats to accommodate eight passengers. Checklists were run in normal sequence. No abnormalities were noted during engine start, and the aircraft blocked out at 0632L and taxied to runway 23.

The aircraft commander, Capt Polizzo, was in the copilot's seat, Capt Mario Cinquino occupied the pilot's seat, and Capt Edmund Rossnagel was in the flight check seat. The primary navigator, Maj Francis Dugan, was in the navigator's seat, and the auxiliary navigator, Maj Jerald Davis, in the right auxiliary crew seat. TSgt John Finley was seated at the flight engineer's station and the scanner, TSgt Pervious Close, was seated on the crew bunk. The primary loadmaster, SMSgt David Moskowitz, was seated in the cargo compartment with the eight passengers while the other two loadmasters, SSgt John Blackley and Sgt Robert Parillo, were in the crew compartment occupying the left auxiliary crew seat and crew bunk seat respectively.

Weather for takeoff was VFR with scattered clouds at 8000 and 20,000 feet, visibility ten miles, smoke and haze east through south, and winds from 050° at 3 knots. The aircraft maintained VMC throughout the flight.

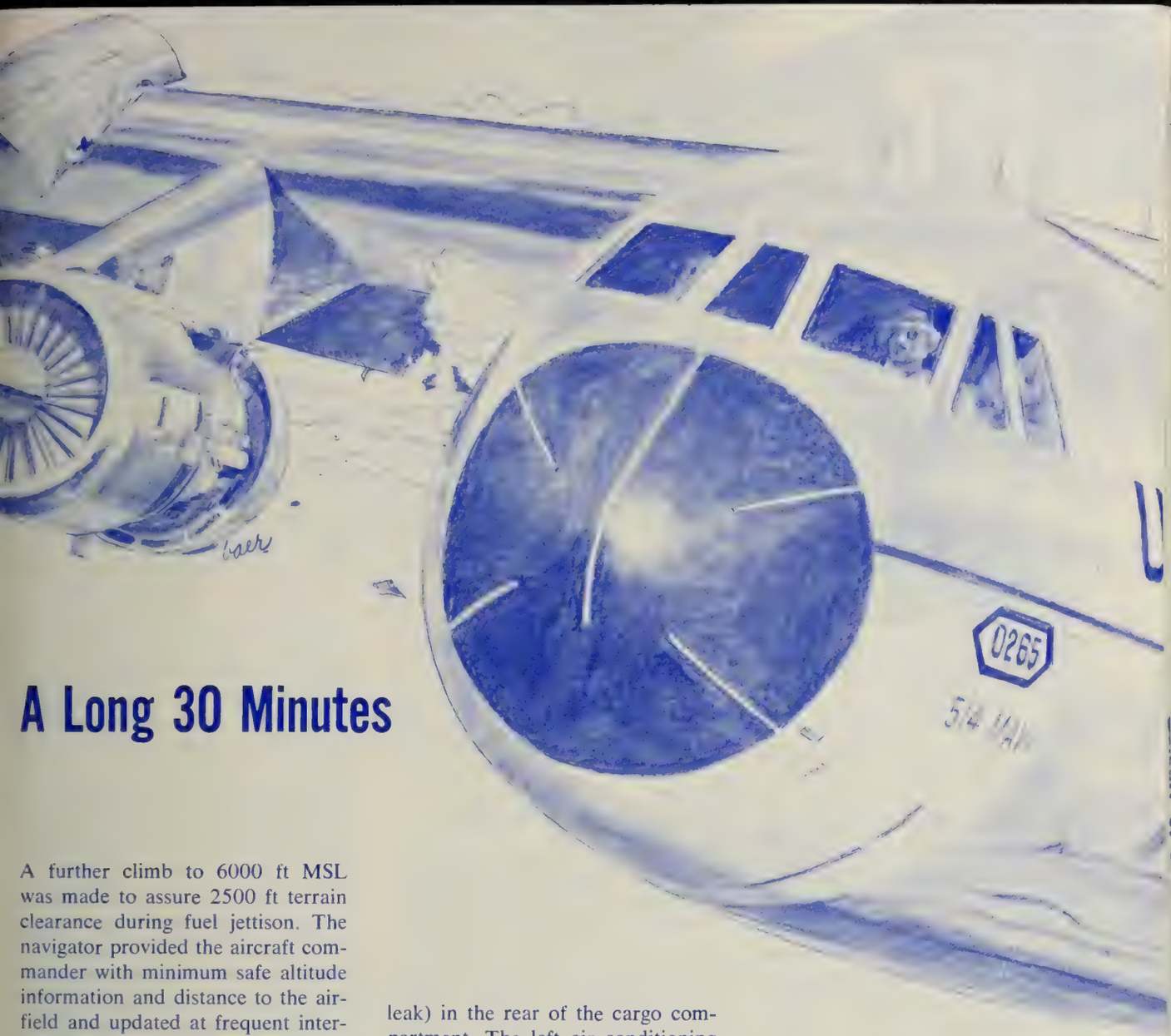
Captain Cinquino briefed a standing TRT takeoff and normal climb-out because of the aircraft's gross weight. All applicable items, including emergency return procedures were briefed prior to departure. Takeoff roll was initiated at 0640L. The aircraft accelerated normally and rotated at 141 knots. Gear retraction was normal and the aircraft climbed out at 150 knots (minimum climb-out speed).

Approximately three minutes after brake release, at 1500 ft AGL (3500 ft MSL) as the aircraft was approaching 175 knots, a loud bang was heard by all crew members and the aircraft yawed to the right. The "nr 3 thrust rev not locked" light and "nr 3 low oil pressure" light illuminated. The nr 3 engine low oil quantity light illuminated on the flight engineer's panel. All nr 3 engine instruments fell toward zero. The copilot, initially believing that the nr 3 thrust reverser had opened, retarded the nr three throttle to idle. The aircraft commander directed the pilot to climb to 5000' at 175 knots (minimum flap retraction speed) and to leave the flaps in the takeoff/approach configuration. Seconds later, the nr 3 engine overheat warning light illuminated. The nr three engine fire handle was pulled and the engine failure checklist was accomplished. The right air conditioning pack sensed an overheat condition and automatically shut down.

Captain Polizzo declared an emergency with Madrid Departure Control, requested clearance to the Torrejon VOR at 5000 ft MSL to jettison fuel, and was so cleared. The pilot made a left turn to the VOR and noted that buffeting could be felt at speeds approaching 180 knots and at bank angles approaching 15 degrees. Throughout the remainder of the flight these parameters were not exceeded. The route for return to Torrejon was planned to avoid overflying populated areas. The aircraft commander directed Capt Rossnagel, in the flight check seat, to advise Torrejon Operations of their difficulties and intentions.

The scanner had gone to the rear of the aircraft to assess the damage. After establishing interphone contact, he observed the engine through the right side escape hatch window and advised the aircraft commander that black smoke and fuel mist were coming from the engine, that the cowling was missing from the engine and that there was damage to the inboard wing flap and the nr 4 engine. He observed additional fuel mist coming from the wing and was able to see a large fuel leak in the nr 3 main fuel tank area. The auxiliary navigator had installed the sextant and advised the aircraft commander that the right side of the cowling had lodged in the leading edge of the right wing and appeared to be stable in that position. He could detect no other damage to either the wing or the empennage.

Captain Polizzo assumed control of the aircraft as it approached the VOR and the pilot, Capt Cinquino, handled all subsequent calls to ATC.



A Long 30 Minutes

A further climb to 6000 ft MSL was made to assure 2500 ft terrain clearance during fuel jettison. The navigator provided the aircraft commander with minimum safe altitude information and distance to the airfield and updated at frequent intervals. The aircraft's flight path carried it over a plateau with a mean elevation of 3000 ft MSL; higher mountainous terrain was located to the west, well clear of the aircraft's flight path.

Fuel jettison was accomplished under radar vectors in the vicinity of the Torrejon VOR. The scanner and one loadmaster took positions in the cargo compartment to observe the fuel jettisoning, while the primary loadmaster and the remaining loadmaster stayed with the passengers to calm and reassure them.

During fuel jettison, the left air conditioning pack overheated and shut down. The scanner reported fuel fumes (probably from the fuel leak) in the rear of the cargo compartment. The left air conditioning pack was returned to operation using the appropriate checklists in order to dissipate the fumes. A controllability check was performed with no control problems noted. Sixty-three thousand pounds of fuel were jettisoned in approximately 13 minutes. This brought the aircraft landing weight down to 256,000 pounds. After the jettison, another controllability check was performed with gear down and flaps approach. The flaps had been left in takeoff/approach position due to the damage sustained by the flap at the time of engine failure.

The loadmaster briefed the passengers on evacuation procedures.

After another controllability check, the aircraft commander flew an approach flap PAR approach to runway 23 at Torrejon.

After touchdown, as the aircraft decelerated, the piece of cowling which had lodged in the right wing fell to the runway. The aircraft was taxiied clear of the runway, stopped, and the engines shut down with the engine fire handles. All passengers and crew members evacuated through the crew entrance door in less than 45 seconds. The fire department immediately began to apply agent to the number 3 engine and right wing area. The flight had lasted approximately 30 minutes, landing at 0720L. ★

THE IFC APPROACH

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

A new service has been initiated by Air Traffic Control to provide pilots with an added degree of safety. This service consists of a low altitude alert or warning given by the controller to pilots of radar identified aircraft that have Mode "C" altitude reporting capability.

The following warning will be given by the controller if he observes a Mode "C" readout which indicates the aircraft is at an altitude which, in his judgment, places the aircraft in unsafe proximity to terrain or obstructions. "RAMA ONE ZERO, LOW ALTITUDE ALERT, ADVISE YOU CLIMB IMMEDIATELY."

The provision of this service by a controller is not mandatory. It may be impossible, due to workload, traffic conditions, or quality of radar, to provide continuous altitude monitoring of all aircraft targets and insure a safe altitude is maintained by all aircraft. Nonetheless, awareness of significant or extreme deviations, in respect to terrain and obstructions, can be expected from controllers on a regular basis. It still remains the pilot's primary responsibility to insure terrain clearance and obstacle avoidance.

NAVAID TIPS

Are you in the habit of setting a channel or frequency in your NAVAID receiver and then accepting any signal that activates it? If you find yourself forgetting to identify and monitor the identification, consider this:

1. When maintenance is being performed on a NAVAID, the identifier may be deactivated. Without the identifier, the bearing and/or DME should be considered unreliable.
2. A garbled identifier, or even a mixture of identifiers, can indicate signals that will cause erroneous bearing and/or DME displays. A false TACAN lock-on may give the bearing and/or DME, and even the identifier of an unwanted station. Usually this station will be one which is supposed to transmit on a channel adjacent to the one selected.
3. It is also possible for the NAVAID receiver to malfunction internally. This occurs when the control head is set to the proper frequency but the receiver section fails to channelize properly. The only means available to insure you are receiving the proper information on your NAVAID display is to tune and properly *identify*, each time you select a new frequency, as outlined in AFM 51-37. Also, be sure to monitor the identifier at all times to insure you are receiving reliable information.

LOW ALTITUDE TRAINING ROUTES

When you fly VFR Low Altitude or All Weather Low Altitude training routes, don't forget to apply the "see and avoid" principle. A recent low altitude accident between a light aircraft and a military fighter emphasizes the necessity to keep your eyes scanning the skies at all times. Be especially alert in the vicinity of small airports. Pilots must always keep in mind their responsibility for continuously maintaining a vigilant lookout, regardless of the type of aircraft being flown or whether operating on an IFR flight plan or under visual flight rules.

LOCALIZER INTERCEPTION FROM DME ARC

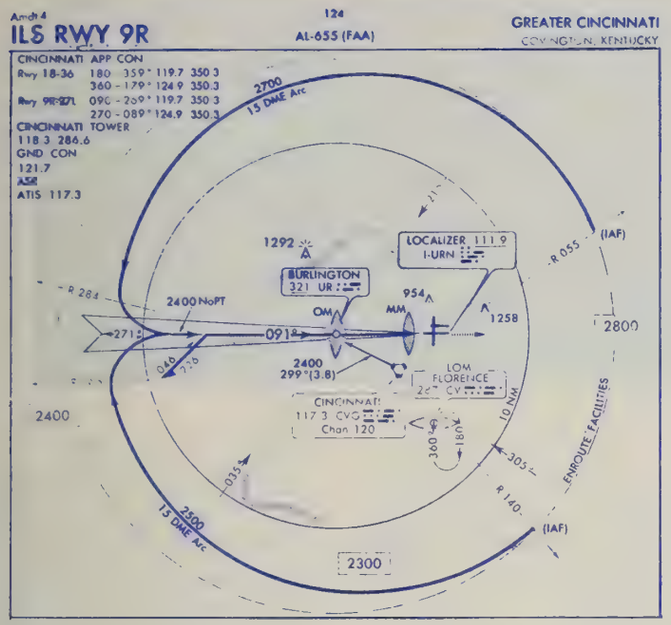
Anyone who has flown a TACAN/ILS in VOR/DME equipped aircraft has undoubtedly had the opportunity to intercept a localizer course from a DME arc. If the VORTAC is located at the airfield, pilots can determine and apply normal arc to radial leadpoints by using techniques offered in AFM 51-37. However, consider the situation (see illustration) where the VORTAC is located at some distance from the airfield. Although the arc-to-radial intercept is similar to that described in AFM 51-37, you will have to adjust your leadpoint to allow for VORTAC displacement.

On the other hand, this computation may be unnecessary since many arc to localizer approaches have lead radials depicted. These lead radials are normally derived from the TACAN associated with the DME arc. AFM 55-9, "U. S. Standard for Terminal Instrument Procedures," states "When the angle (interception of the arc and the course) exceeds 90 degrees, a radial which provides at least 2 miles of lead shall be identified to assist in leading the turns. . .". The FAA normally depicts lead radials on all arc to localizer approaches. This is necessary to provide a lead point for civil aircraft equipped with paired frequency VOR/DME receivers and still enable these aircraft to receive DME information until the aircraft turns inbound on the localizer.

As a technique, when established on the arc, set the published localizer front course in the course selector window. When at the lead radial, simultaneously begin your turn to intercept the final approach course and if you have a flight director system installed, select the desired mode of operation. Then fly the approach as published using normal LOC/ILS procedures.

REVISION OF "IFC APPROACH" ARTICLES

Each year the IFC reviews the "IFC Approach articles that were published during the past three years. This review identifies changed or incorrect information.



Articles considered current are those published after December 1972 excluding the following:

DELETE

August 1973, entire article.
May 1974, 3rd question, answer and figure.
August 1974, 1st question and answer.
December 1974, 2nd question and answer under Initial Approach Fixes (IAFs).
June 1975, 5th question and answer under Helicopter Pilots.
July 1975, 3rd and 4th questions and answers.
August 1975, 8th question and answer.

CHANGE

Change all references to "Flip Planning, Section I" or "Flip Planning, Section II" to read, "Flip General Planning" in the May 1973, July 1974, November 1974, December 1974 and January 1975. November 1973, 2nd column, 1st page, paragraph 4. Change "AFM 60-16" to read "AFR 60-16" and change the quote from AFR 60-16 to read, "the minimum altitude for IFR operations is governed. . .".
January 1975, Helicopter Pilots, 2nd answer, change to read, ". . . in FLIP, GP, under aircraft categories and holding procedures."
September 1975, change reference to "sectional charts" to read "Tactical Pilotage Charts."
November 1975 second column, line 21, change to read "approximately 900 feet" vice "approximately 180 feet."
Second column, line 26, change to read "4500 feet" vice "900 feet."

The USAFIFC will provide an answer to any question related to instrument flying. Is it an approach design or depiction? Call AUTOVON 487-4274. A question about flight regulations or directives? Call AUTOVON 487-4276. ★

CONSOLIDATED MAINTENANCE



Sgt Isiac T. Potter and A1C Francisco Cruz are now both members of the 4th Field Maintenance Squadron electric shop. The left pocket of Airman Cruz's fatigues shows where his SAC patch used to be.

SAC and TAC are testing a new way of organizing maintenance resources at Seymour Johnson AFB, SC. The consolidation which started in October combines the total maintenance resources of the 68th Bomb Wing (SAC) and the 8th Tactical Deployment Squadron (TDCS) with those of the 4th Tactical Fighter Wing (TAC).

This test is to determine whether such a consolidation is practical and if it works better than the old system of separate maintenance organizations. Under the old system, maintenance personnel who came to Seymour Johnson were assigned to either the 68th Bomb Wing, the 8th TDCS or the 4th TFW. Now all the maintenance organizations on the base are part of the 4th Tac Fighter Wing.

The chief of maintenance for the 4th TFW now has some 2200 people working for him and his troops have also "inherited" maintenance responsibilities for B-52's, KC-135's and EC-135's in addition to their F-4's. ★

MICHAEL GROST
Martin-Baker FSR
PACAF

FOD in the F-4 EGRESS SYSTEM



To the majority of people involved with the maintenance upkeep of USAF F-4 aircraft, the term FOD should be a pretty familiar one. On flightline areas, clearly marked receptacles for FOD generally abound and the subject is one which is constanly discussed or reviewed. However, despite rigorous attempts to eliminate *foreign object damage* the scourge continues to be a wily adversary and one which takes a lot of containing. Consequently it should never be underrated, because not only does it adversely affect fiscal budgets, through repeated equipment damage, but of far deeper concern—it can indeed destroy life itself!

While the FOD problem has understandably received a lot of attention over the years, much of its publicity would appear to have centered on its more dramatic side. Thus, when considering FOD results, images are more often conjured up of how engine compressor blades can be wrecked by some innocuous looking ½ inch bolt, than a gouge in some less interesting structure. Nevertheless it is pretty obvious that FOD can strike at just about any aircraft system or supporting activity, which in time may prove to be equally disastrous. So, for the purpose of this brief discussion let's talk about the "FOD Foe" within the context of its potential to the *egress system.*

Imagine for a moment the end results of an aircraft accident, wherein FOD prevented the correct operational sequence of an ejection seat. The term "lethal outcome" would probably sum up such an ejection—or an attempt! This depressing supposition is based upon the typical circumstances of many aircraft escapes, with limited time remaining for system operation and the inability of designers to provide extensive backup system capabilities. In short, any unplanned delay or induced system failure would normally have dire consequences for crew escape. Accordingly, whereas the affects of FOD in another system might force a crew to eject, in the case of egress equipment FOD damage the final chances for crew survival would probably be erased. This somber point should make it very clear that egress systems must be checked thoroughly, to ensure that they remain unhampered by FOD, to enable them to provide their optimum performance at time of need.

Although the aforementioned details would appear to be obvious, other associated problems make the task of checking for FOD in the egress system a difficult one. Unlike most systems, egress equipment cannot be test run before each flight to ensure that it will function correctly; therefore, determining whether FOD is present and whether it may affect the system will normally depend solely upon visual inspection. This action is of course time consuming and one which is complicated by the irregular shaped masses of most current egress assemblies, along with limited surrounding access areas. But, the job can be done, and judging from the past maintenance-related egress survival record, many technicians are not content to just tick off that final installation checklist or preflight card. They also provide that added (and extremely vital) visual check of the surrounding area. While such actions as this could be termed as "the professional approach to aircraft maintenance" or "dedicated efforts," such written kudos as these often draw varying feelings. However, to those individuals who do extend that extra effort, the personal realization of the importance of their job is very clear

and they obviously appreciate the meaning of that word—responsibility. True, the task may take a few extra minutes, which may technically not be clearly defined as a requirement, but in egress work that additional effort may well save someone's life and that's what egress is all about.

To conclude this coverage of how FOD in the egress system can produce extremely serious consequences, the following report may be of interest. In this instance the FOD was found in time, but tomorrow's FOD problem still has to be eliminated . . . or again be found in time by someone else, and that takes the concerted effort of all of us.

". . . The mission was an (F-4) ACT sortie. When the crew chief attempted to install the seat pins after the flight, he noticed that the linkage above the FCP seat mounted initiator was partially extended and that the annular groove was exposed. The crew chief was also unable to install the FCP seat mounted canopy initiator pin. Egress specialists were called and after inspecting the ejection system found a foreign object lodged in the lower "D" ring ejection control linkage behind the FCP seat. They then safetied the seat by disconnecting the initiator's ballistic hose. Next, the linkage above the seat mounted initiator was disconnected. This allowed the mechanism inside the initiator to reseat to its normal position and the pin to be installed. External electrical power was then applied to the aircraft and the FCP seat was lowered. This allowed the foreign object to be extracted.

". . . The foreign object was the Armament Safety Override Button. It is probable that the button came loose in flight since the AC stated that he had engaged it during his before takeoff checks. Investigation also revealed that the set screw on the button was loose. The linkage on the top of the FCP seat mounted canopy initiator probably extended as the seat was raised following the AC's engine shutdown check.

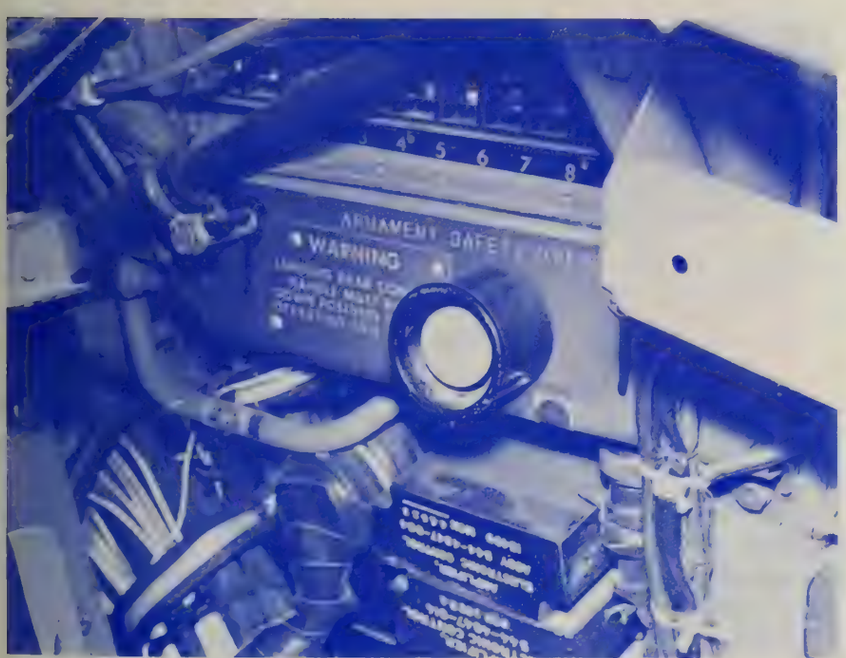
"The set screw on the Armament Safety Override Button was loose for some undetermined reason thus allowing the button to work its way loose.

"The involved TFW performed a one time inspection of its F-4 aircraft. Seventeen Phantoms had loose Armament Safety Override Buttons, due to either missing or loose set screws. Recommend other F-4 units conduct similar inspections.

"Aircrews, MMS and OMS personnel will be briefed on this incident. This briefing will emphasize the dangers associated with loose objects in the cockpit"

This article was written by Mr. Michael Grost, the Martin Baker Aircraft Co Ltd Field Service Representative to PACAF. Mike has been in SEA since 1968 and his experience and knowledge of egress systems make him an acknowledged expert in this field.

While this article is addressed primarily to the maintenance technician, there are some important points for aircrews. In particular: Why weren't the loose Armament Safety Override Buttons recognized and reported as hazards?—The Editor. ★



The armament safety override button has been the cause of at least one FOD incident.

No pilot can experience it all,
make all the mistakes himself,
learn all the lessons himself.

That's why we learn from others.

That's why experience is
one of the great teachers.

That's why we're all teachers
when we share the
experiences we've had.

From TWA Flite Facts Bulletin
October 1975

THE HIGH COST OF ACCIDENTS TODAY

MAJOR THOMAS R. ALLOCCA
Directorate of Aerospace Safety

"Modern accidents are expensive . . . prohibitively so!"

State-of-the-art technology and aerospace industry advancements have provided USAF with aircraft which, when compared with their predecessors of a short time ago, are truly impressive.

"One C-5 can airlift as much as 10 C-124's in less than half the time."

"The B-1 will be capable of carrying three times the internal payload of the B-52."

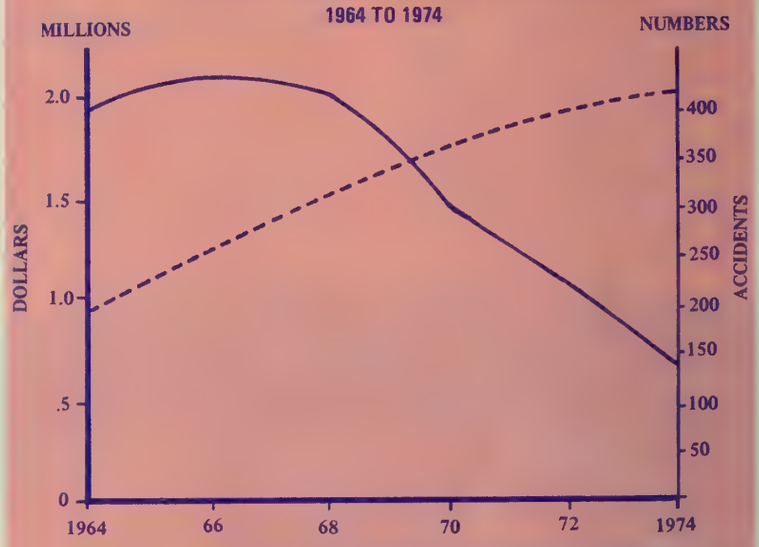
"An E-3A airborne warning and control system (AWACS) aircraft can perform its vital mission with far more accuracy and versatility than the EC-121."

If there's a common theme to be found in these and a host of other examples, it's simply this: American industry is producing aircraft with mission capabilities and performance which are indeed mind-boggling. But this increase in aircraft mission capability has been accompanied by another increase which is also growing at an unprecedented rate: The cost of a mishap.

The decade from 1964 to 1974 serves as a convenient basis for comparing accident costs. In 1964 USAF experienced a total of 391 major and minor aircraft accidents. Those accidents resulted in a loss of 368 million dollars, for an average of $940,000 per accident.

In 1974, 141 major and minor accidents occurred, resulting in a loss in excess of 312 million dollars —an average of $2,200,000 per accident. So while Air Force decreased the total number of accidents by 64 percent, the average dollar loss per accident increased by 144 percent.

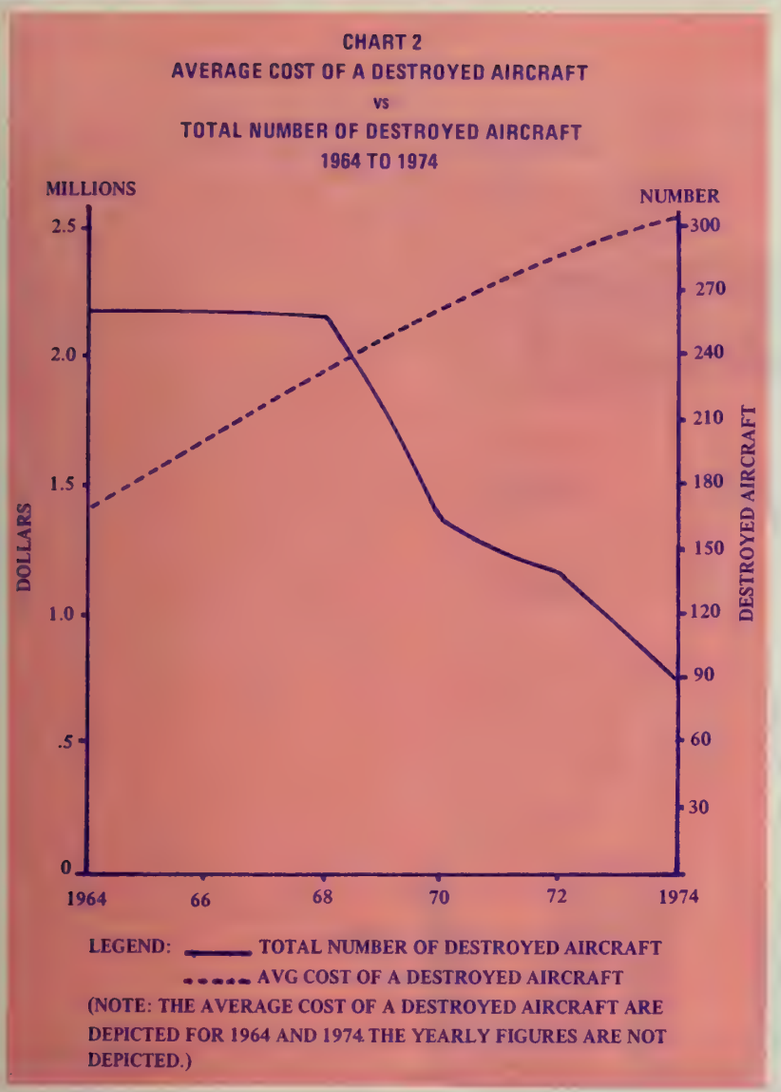
CHART 1
AVERAGE ACCIDENT DOLLAR LOSS
vs
TOTAL NUMBER OF MAJOR/MINOR AIRCRAFT ACCIDENTS
1964 TO 1974



LEGEND: —— TOTAL NUMBER OF MAJOR/MINOR ACCIDENTS
---- AVG ACCIDENT DOLLAR LOSS
(NOTE: THE DOLLAR LOSS FIGURES ARE DEPICTED FOR 1964 AND 1974. THE YEARLY FIGURES ARE NOT DEPICTED.)

A similar review of aircraft destroyed data reveals trends approximating those in Chart 1. In 1964, a total of 262 aircraft were destroyed, resulting in a dollar loss of 363 million dollars. In 1974, 90 aircraft were destroyed at a dollar loss in excess of 253 million dollars.

Chart 2 presents the contrast suggested by these statistics:



Once again a decrease of 66 percent in the number of aircraft destroyed was accompanied by a 107 percent increase in the average cost of a destroyed aircraft.

Within the same decade referenced earlier, our national leaders have become increasingly aware of public demands for the restructuring of national priorities and objectives. Coincident with these demands, and given equal publicity, has been the fact that the resources with which these objectives will be achieved are limited. The result of this rhetoric has been that it is now imperative to derive maximum benefit from all resource consumption. And inflation has added another element to the problem of resource conservation.

In 1964 the total defense budget was 50.5 billion dollars; in 1975 the figure was 92.4 billions. However, when corrected for inflationary increases, the actual increase in defense spending was 4.0 billions. Using 1964 as a base, that represents an eight percent increase from 1964 to 1975. It requires little in-depth analysis to realize how modest an increase the eight percent is; furthermore, it underscores the pressing need to conserve defense resources.

The statistics mentioned earlier and depicted in Charts 1 and 2 suggest that USAF safety efforts have resulted in significant improvements in our accident statistics. In the five-year interval from 1970 to 1974, the major accident rate has consistently fallen in the 2.3 to 3.0 (per 100,000 flying hours) range and this represents a substantial improvement over the same interval of a decade earlier. However, the statistics presented also indicate that these advancements may be more than offset by the prohibitive costs involved in the loss of a modern weapon system.

The significant mission capability represented in a single C-5 or B-1 or E-3A is balanced by the substantial national investment involved in each of these systems. And while one of these new or "developing" systems can do the job of ten of its predecessors it is imperative to recognize the fact that a loss of one can be roughly equated to losing three or five or some appropriate multiplier of its predecessors. And it is this loss in mission capability which USAF can ill afford.

The aircraft losses and mishaps which serve as the "data base" for the figures presented in Charts 1 and 2 do not, in large measure, include systems such as the C-5 and F-15. Rather these accident statistics include many aircraft now retired or "soon to be retired" from the active fleet. Many of these systems, such as the B-47, C-119, and F-84, were built at a fraction of the costs of their successors. It is, therefore, reasonable to assume that the "cost" trends indicated in Charts 1 and 2 will continue to be inversely related to USAF's safety statistics. The only acceptable answer to offsetting the effects of these trends is to continue to decrease our accident rates; but the slope of the "accident-rate" line must be steeper than that of "accident-cost" line.

As USAF accepts these developing systems from industry, we must insist that the same type of effort devoted to improving mission performance and capabilities will be devoted to enhancing the "safe operation" of the aircraft. It then becomes incumbent upon us, the user, to maintain and operate these systems as "accident-free" as possible. We cannot afford to do otherwise. ★



LT COL RICHARD B. DURANT
Directorate of Aerospace Safety

"Safety first;" "Safety will not be compromised;" "All personnel were briefed (rebriefed)." We all believe in motherhood, apple pie, and safety because they are—well, good.

We are told that no job is done well unless it is done safely. From that point on the water gets murky. How do we be safe? What is an acceptable risk? Unfortunately, these questions sometimes become lost in the pressure cooker of the real-world Air Force. Occasionally someone waves the flag, writes a letter, or even has a campaign, but little of substance is accomplished until a serious accident occurs. Then a very important element of the safety program is applied: the formal accident investigation. This is after-the-fact accident prevention, and it hurts.

An example: A supervisor drove two workers to a job that involved a hazardous operation. It was the beginning of the shift and after delivering the workers to the job, the "supervisor" returned to his office. Thirty minutes later a catastrophic explosion and fire occurred which resulted in the death of one employee and the total loss of a $40 million weapon system. The cause? Untrained workers performing a task with improper equipment. Avoidable? You bet!

The investigation revealed inadequate written procedures, poor to nonexistent supervision, and inadequate guidance and control from the upper levels of management. The corrective action was swift and effective—but too late.

That horror story illustrates that nothing will destroy an Air Force unit's capability and morale as quickly, devastatingly, and completely as a major accident. Since the success of a unit's mission is dependent on the adequacy of its

resources, the conservation of those resources is as essential to a commander's attention as the mission itself. The safety program deserves much more than lip service.

Top management in the field—the wing and squadron commanders—are often faced with pressing and essential mission demands. An example is when the ORI team shows up in the middle of the lousiest weather the base has experienced in five years. The commander and his unit immediately go into high gear: recalls, last minute maintenance activity getting the birds ready and uploaded, briefings, and finally the moment of truth—launch. Usually the last words spoken by the leader are: ". . . and above all, safety is paramount."

Unfortunately, unless he has established a tradition of safety being an integral part of his operation, no one will take those words seriously. Maintenance people will take shortcuts to get aircraft turned around. Pilots will press their targets and minimums (just a little), and maybe someone won't be quite so careful of the parts they hang on airplanes. Most of the time the unit is lucky; occasionally a dead pilot, a badly injured crew chief, or an out-of-work wing commander attests to the fact that the unit's luck ran out.

There is a commonality in all Air Force safety programs which is based on written Air Force and major command directives. However, at some point the programs part company and vary vastly in their effectiveness. The key to the success of a field unit's safety program depends on the individuality, ingenuity, inventiveness, and energy of the people involved. If we accept the premise that people are the driving force in safety programs, it is worthwhile to take a look at how they contribute.

There are four "people" elements in any safety program. The cornerstone on which all else rests is the top manager—the commander. He is the one who establishes policy, provides the clout and sets the example. If he is content with lip service then the safety program ends right there. A commander who encourages, or even tacitly allows, shortcuts in his operations cannot hold his supervisors responsible for the resulting accident. If he believes that safety is an integral ingredient of mission accomplishment; his job is cut out for him, as we shall see.

The second people element is the safety manager. He is the one responsible for keeping his finger on the pulse of the safety program and keeping the commander up-to-date on the state of its health. His task is c o m p l e x and involves administering the safety program, keeping the commander informed, m a k i n g recommendations, and maintaining follow-up on a c t i o n items.

The job cuts across all functional lines and into all functional areas. To do it properly the safety manager must have access up, down, and laterally. You can bet that any commander who puts filter layers of managers between himself and his safety manager will never know the true status of his safety program—until a catastrophic potential is realized. Safety managers have no command authority and can't be the action agency to get problems corrected. However, too often the safety manager is the only active participant in the unit safety program. In such a case, a commander could consider his program as operating at 25 percent efficiency.

The third "people" element is middle management—the functional managers and supervisors. Accidents due to unsafe acts (85 percent nationwide) are not caused by the safety officer, as some believe, but are caused by the people doing the work. The supervisors are the people with direct control over that work, so the importance of their link in the safety chain cannot be overstated.

The commander must make certain that when he establishes safety policy, his middle managers know that he means what he says. He must then give them direct responsibility for the safe conduct of their operations. Finally, they must be educated. Safety officers can never find all the procedural and physical hazards that exist in a unit. The supervisors must be trained to identify potential hazards in their areas and they must know what to do about them.

Because the supervisor provides the direct interface with the workers he must be responsible for their safety awareness and discipline. He must see to it that workers know the hazards of not only their particular tasks but the work environment. And the supervisor's most important—and difficult—task: he must be certain that the procedures for doing the job in his area of responsibility are adequate and that his people follow them.

The final people element of a safety program is the worker. In essence, it is toward him that the total safety effort is directed. It is his hazard awareness and discipline in following the proper procedures that ultimately prevents the accident. The entire safety effort is wasted if it does not impact the worker. How effectively it impacts him may well determine a commander's effectiveness as a manager.

One final thought: which "people" element would you consider to be the most important to a safety program? Conversely, which link in the safety chain could you most afford to eliminate? ★

Fly-In On Midairs

The photos on these pages may make you wonder what is going on. Is the Air Force converting to lightplanes? Hardly; those people and general aviation aircraft were guests of the 35th Tactical Fighter Wing at George Air Force Base.

The wing hosted flyers from the area for displays, films and a briefing on low-level training routes. The objective was the prevention of midair collisions through education of the flying public. A package containing maps of low-level routes, safety posters, and a pamphlet containing facts on low altitude military operations was sent to 29 airports in the area. Also included was an invitation to visit George Air Force Base on October 25. More than 800 people flew or drove to the base, and the count on airplanes was 217.

Meanwhile, on the other side of the country, Eglin Air Force Base has been conducting a continuing public education program with the same goal: prevention of midair collisions. The program includes letters discussing areas of potential for midair collisions and offering advice for general aviation pilots flying in the Eglin area, maps of low-level routes and posters for airport display.

There are no doubt many other similar efforts being conducted by other Air Force bases. A fly-in such as staged at George Air Force Base will require a certain amount of planning and work. But, if it prevents a midair, the return seems worth the effort.

The George AFB ramp took on a new look during the Fly-In. The response to the Fly-In by the civil aviation community was tremendous as shown in the view of the parking ramp. Despite the heavy traffic on the ground, things went well and if a pilot had problems he soon received help.











One of the most dramatic events was a demonstration of crash/rescue techniques by the George AFB Fire Department. The picture above shows the trucks moving in to fight a simulated aircraft fire.

The sequence of pictures to the right shows how the crew of an F-4 would be rescued in an emergency on the ground.

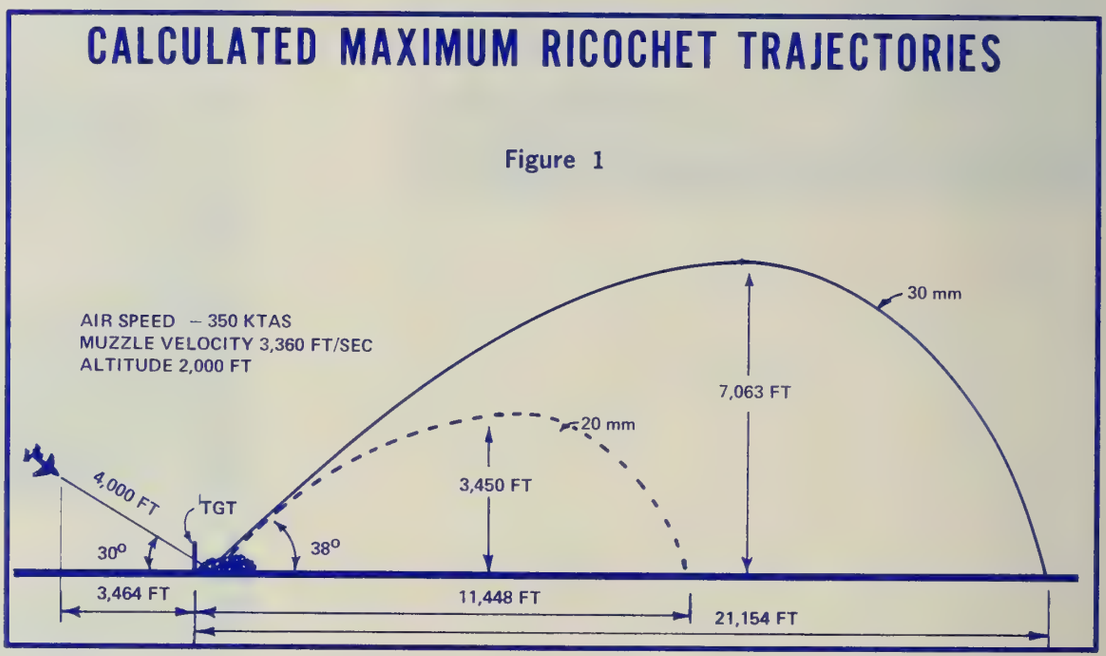


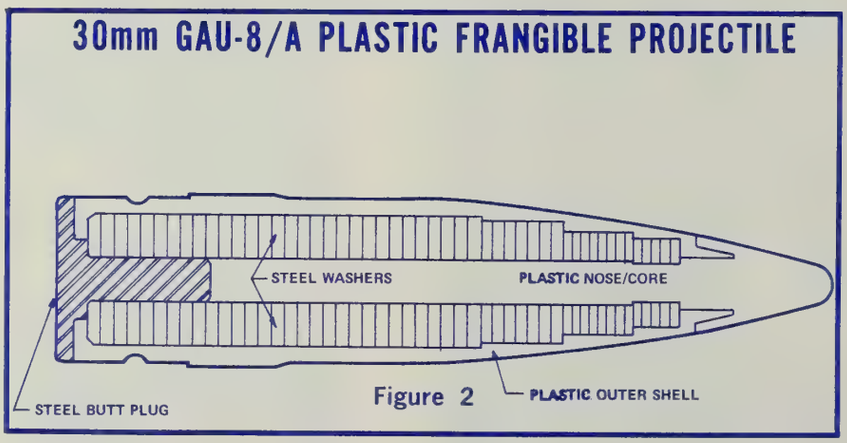
he day's activities included static displays of r Force aircraft (left), a discussion of psysio- gical problems of flight in the altitude cham- er (below), and a ride in the F-4 simulator ight).



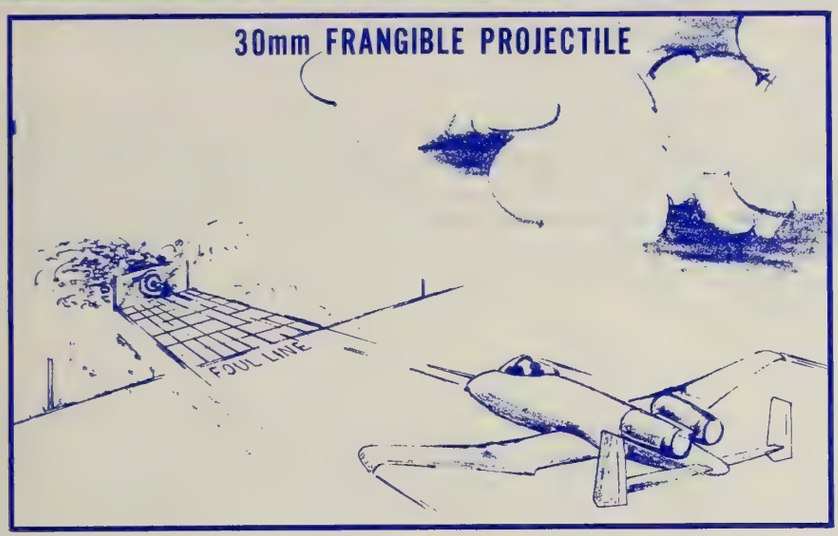
Ricochets

LT COL JIM LEARMONTH, Directorate of Aerospace Safety





As a young lieutenant, my first contact with ricochets was through the experience of a friend. When the F-100 was the USAF mainstay in Europe, this friend returned from the range at Wheelus AB with a torn intake duct and minor damage to the turbo-jet due to 20mm ricochet. Although, (let's call the pilot Joe) didn't notice any vibrations or any change in engine performance, the local forces changed out the motor. As TDY tenants we were suspicious of the locally overhauled J57 which replaced our damaged item. Three days later the aircraft and pilot were lost at sea after an engine failure. The lieutenant continues to register mentally that the colonel died as a result of a 20mm ricochet.



That's certainly far from the truth, of course, but the truth is that we have, over the last 10 years, lost two fighters and officially recorded 271 such incidents (156 F-4s). In the last 3½ years, USAF has spent 1.3 million dollars on aircraft parts alone to repair ricochet damage incurred during routine practice strafing missions.

Positive action to eliminate the causal factors has included movement of the cease fire point to 2000' minimum slant range. (I remember it at 1000' and the old heads spoke warmly of the days when it was 600'.)

Plowing and cleaning of ranges at regular frequent intervals have reduced the instances of ricochet damage but have not eliminated it.

Currently, the USAF has a limited number of strafing ranges for 20mm cannon. This is largely because of the safety "fan" required behind the target to contain long ricochets. With the development of 25mm and 30mm aircraft cannon with larger projectiles and higher velocities, the size of the safety zone required will increase. Additionally, these weapons represent a considerably more serious ricochet damage potential (See Figure 1).

Recognizing the increasing seriousness of this problem, a program was established to produce a nonricocheting target practice projectile for aerial cannons. To meet this objective, the frangible projectile was conceived, embodying a new and radical design of target practice projectiles (Figure 2). The outer body was made of molded plastic while the inner body was made up of steel washers or platelets. This design was established after considering the applied loads, as well as economy and simplicity.

During initial acceleration, the bullet is subjected to an axial compressive setback force of about 120,000g. As it travels through the barrel, it attains a high spin velocity (120,000 rpm) with an attendant centrifugal force applied to the sides of the projectile. The design of the bullet permits it to easily handle these loads; however, upon impact, the relatively weak plastic skin, in conjunction with an instantaneous unbalanced loading at impact, causes the skin to rupture and scatter the washers. The washers, because of their relatively low energy (available kinetic energy divided by the number of washers per projectile) and their low sectional density and high drag factor, cannot travel as far as an intact deflected bullet.

It may be some years before we see this type of ordnance in air-to-ground practice munitions; however, the technology is being advanced. The round has performed satisfactorily in preliminary tests. This may just be the answer to the ricochet problems of the future. During the interim, let's make the pullouts brisk and, if anything at all, early. Let's all be around when the frangible projectile arrives.

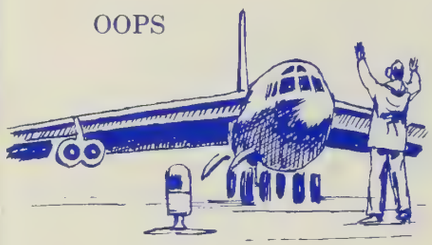
Written in cooperation with Major Stephen J. Bilsbury, formerly with Air Force Armament Test Laboratory, Eglin AFB, FL. ★

OPS TOPICS

CORRECTION

In the October 1975 Ops Topics item entitled *Over-G* the instructor was a weapons system operator, not an instructor pilot.

OOPS



The B-52 was taxiing back to parking after an aborted takeoff at a transient base. The marshaller directed the pilot to swing left in order to complete a 180 degree right turn. During the left turn the left main gear trucks ran over a raised taxiway light destroying it and requiring tire changes on three tires.

ATC PROCEDURE CHANGE



A new ATC change revises the procedures used for clearing an aircraft for an instrument approach when operating on an unpublished route. (An unpublished route is defined as a route for which no minimum altitude has been published or charted for pilot use.) This may be a direct route between navaids, a radial, radar vector, or a final approach course beyond the segments of an instrument approach procedure.

Under the revised procedure, ATC will issue the approach clearance only after the aircraft is:

1. Established on a segment of a published route or instrument approach procedure or
2. Assigned an altitude to maintain until the aircraft is established on a segment of a published route or instrument approach procedure.

The significance of this change is that now ATC is responsible for furnishing altitude assignments to aircraft flying unpublished routes in terminal areas. This procedure provides a double-check between the controller and the pilot on the proper altitude to maintain for terrain avoidance.
The new procedure supersedes the similar procedures used in the past for aircraft receiving radar vectors. Now all aircraft, those on vectors and those flying unpublished routes via aircrew navigation, will receive altitude guidance.

When an aircraft is established on a published route where charted altitude information is available (a segment of an instrument approach procedure or an airway), the aircrew is still expected to comply with applicable published altitudes unless otherwise directed by ATC (AFM 51-37).
These procedures are published for controllers in FAA Handbooks 7110.8D (Terminal) and 7110.9D (Enroute). A new handbook will be published in January 1976 consolidating the Terminal and Enroute volumes.

THE GUST GOT 'EM



Two pilots from a sister service were making an approach to a helipad in a UH-1. The pilot was not happy with the approach and started a go-around. During the attempted go, a wind gust estimated at 35-40 knots caught the Huey, spun it 180 degrees, caused a hard landing and $1500 damage to the landing gear and fuselage skin.

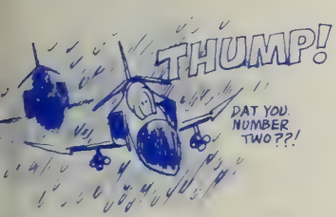
OPS TOPICS

CO CAN KILL



Shortly after takeoff, the navigator and radar navigator on a B-52 experienced mild eye irritation and smelled an unusual odor while on normal oxygen. None of the other crew smelled the odor since they were all on 100% oxygen. After about 8 minutes of searching for the source of the fumes, both the nav and the radar began to experience symptoms of hypoxia. They both went to 100% oxygen and the pilot declared an emergency. After fuel was burned down to landing weight, an uneventful landing was made. Maintenance then discovered that nr four engine had used an excessive amount of oil. It is probable that the oil fumes generated a high level of carbon monoxide which caused the radar's and nav's symptoms of hypoxia.

LOST WINGMAN



The flight of two F-4's was making a recovery to home base. There were numerous heavy showers in the area so lead was trying to pick his way through them. The flight had just taken up a new heading to avoid the heaviest of storms when they entered an area of heavy rain and light turbulence. After about 5 seconds the WSO in the lead aircraft stated that he had lost sight of nr two. Then lead felt a thump when he was hit by two. After he hit lead, nr two turned away and executed lost wingman procedures. Shortly thereafter, the flight broke out of the showers and in VMC rejoined and executed the recovery.

TURBULENCE



The T-39 was cruising at FL370 when it encountered high cirrus clouds. The crew queried ARTC for best radar routing since the T-39 had no radar on board. Center checked with a commercial airliner which reported no turbulence along the planned route. The crew checked on weather along the route once again when they changed frequencies. Again there was no turbulence reported. Shortly after entering the cirrus, the aircraft encountered moderate turbulence and nr one engine compressor stalled and flamed out. The crew got clearance to descend, and after restarting the engine made a recovery at home base without further incident.

NEAR MISSES AND NAVIGATION

A recent near miss was the result in part of a misunderstanding between aircrews and air traffic controllers. It seems that the aircrew of a tanker on a refueling track expected periodic vectors to stay within refueling air space. Unfortunately the controller was not aware of this requirement. As a result, the tanker/receiver combination strayed to within 5 miles of an airway centerline. The center then took action to preclude a midair with a civil jet through altitude separation. Regardless of the details of this incident, aircrews should remember that the *primary* responsibility for navigation remains with the aircrew no matter what air traffic control service is provided. ★

WEAPON SAFETY TOPICS



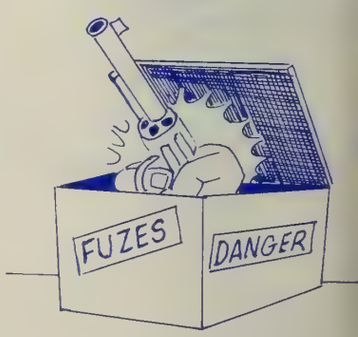
SAFETY—WHO IS RESPONSIBLE FOR IT?

Safety personnel at all echelons are faced with the selling of safety as the responsibility and concern of everyone—supervisors and workers. Many words have been written and said about the matter, but perhaps an Air Force captain said it best a few years ago:

"Safety is not something one can take or leave alone. It is not an activity that is participated in only when one is being watched or supervised, or when there's a safety man around. Safety is not posters, slogans, or rules; nor is it movies, meetings, investigations or inspections.

"Safety is an attitude, a frame of mind. It is the conscious awareness of one's environment and actions all day, every day. Safety is knowing what is going on, knowing what can injure anyone or anything, knowing how to prevent that injury and then acting to prevent the injury or damage. To do this does not require a genius or a PhD or even a degree or a title of rank. All it requires is intelligence and a reasonable amount of native ability to see, hear, smell and THINK. To ignore safe practices does not indicate a brave person, only a foolish one; and to do things safely and correctly is the mark of a wise man, not a timid one."

READ AND HEED!



BEWARE—ARMED FUZE

During an annual inspection of FMU-7/B fuzes, rust was found on the containers. Additional examination revealed that several hermetically sealed containers of fuzes had been previously opened and improperly resealed. Upon examination of the fuzes, one was found in the armed position with its firing pin protruding through the foil on the head of the fuze. Improper packing, handling, and shipping procedures apparently resulted in the arming of the fuze. Additionally, the boxes were inadequately marked in that they did not identify that the fuzes were not hermetically sealed.



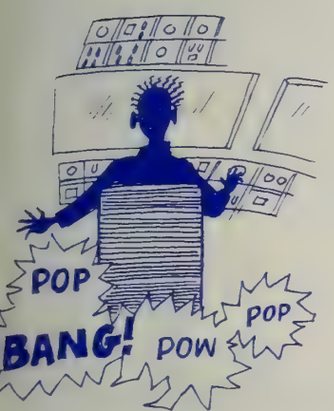
AN ACCIDENT CAUSED ACCIDENT?

During a reentry vehicle (RV) mate, an anomaly occurred in the hoist system. To stabilize the RV the missile maintenance team disconnected the umbilical come-along and performed a hasty mate on the umbilical. Four days later, a wet missile was discovered—a result of the hasty and incomplete mate.

At another unit a wet missile was found. During removal of the missile for return to depot, a step in the checklist was missed and the lower umbilical wasn't disconnected.

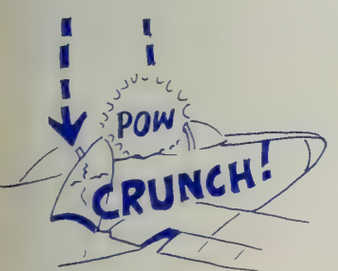
In yet another case, during initial inspection, a team member noted the umbilical coolant line was leaking and attempted to stop the leak. Unfortunately, instead of reconnecting the coolant line he disconnected it. Result—a damaged guidance and control unit.

In each of these cases, further damage, and perhaps another investigation, was caused by another error after the original mishap occurred. Safety and maintenance personnel must stress the necessity for carefully evaluating the mishap before further action is taken. In the above examples, time was not a factor and the damage was even more unacceptable as a loss of resources than the original mishap. Slow down, don't compound an error with another error.



THE SEAT OF THE PROBLEM

Two Propulsion Branch technicians were dispatched to a B-52 to perform an engine runup. Upon entering the cockpit, the technician checking the copilot's seat could not see the nr one safety pin or streamer in the right arm rest. To facilitate his search for the pin, he sat down in the seat and jiggled the arm rest. Thinking it might be in place inside the arm rest he raised the arming lever. Five initiators and three thrusters functiond as designed. Ejection was prevented by safety pins two and three being in place. AFR 66-51 directs that anyone having access to aircraft with egress systems will be trained in the safety and security of the systems. How did this happen?



TRY IT—IT WORKS

During a normal maintenance operation, the canopy would not open. When an attempt was made to open it, the emergency canopy jettison system was activated. It worked. The canopy glass was broken, the upper backbone of the fuselage and the right wing were damaged, but the canopy was no longer stuck.



TRIPPED UP AGAIN

An augmentee security guard was severely burned when an M49A1 surface trip flare functioned in his hands. Since he was an augmentee, the question is raised whether he had adequate warning, training, and supervision. This question is raised because just 9 days later an untrained and unsupervised civil engineer worker was also seriously burned when another M49A1 trip flare functioned in his hands while he was repairing a fence. Neither of the injured was authorized to handle the flares, but perhaps through their lack of training and supervision they weren't convinced. ★

LTJG KIM A. KING
VA-215
NAS Lemoore CA

HOW STRONGLY DO



If you are tempted to fly over mountains—or any other cold terrain—in winter wearing summer clothing, think twice . . . and remember LTJG Doody.

Scenario: LTJG Gordon Doody, VA-215, is sitting in the cockpit ready to move. His thoughts go like this . . .

"Well, it's just about time to taxi out. Everything checks out okay. I'll just wait for the plane captain to give me the signal, and then it's off to do a little DCM . . .

"Wait a minute! What's going on here? The skipper is heading out this way with that SERE-type (survival) LCDR. I wonder what they want. Maybe he wants to tape some jet engine sounds for that film the squadron just did . . .

"Now why in the hell do they want me to shut down? I haven't done anything wrong. Or have I? Hope the old man didn't see me clowning around in the cockpit a minute ago. Well, I guess I'll soon find out . . ."

The CO, CDR R. D. Mixson, speaks . . .

"Congratulations! You have just ejected over the Sierras. All you have with you is your chute, seat pan, and present flight gear. This is LCDR Dick Ritz. You will follow his orders. Good luck!"

And a few last words from LTJG Doody . . .

"Great pork! This can't be true!

"We're not really going to the mountains, are we?"

With that brief exchange, VA-215 SAREX (SAR Exercise) 1-75 began. The exercise scenario, developed by LT Sergei Kowalchik, the VA-215 safety officer, and LCDR Gary Ostrander, VA-215 operations officer, was based largely on the element of surprise. First, a date for the exercise was chosen. Then a time slot was picked on the daily flight schedule. Ironically, the schedules officer, LTJG Gordon "Howdy" Doody unknowingly wrote himself into the slot chosen. He was allowed to man and start his aircraft—thinking all the while that he was going on a DCM hop. We've al-

YOU FEEL ABOUT LIFE?



The SAR helicopter lifts the "survivor" into a preselected meadow at 8000 to 8500 feet.



LTJG Doody finds a spot clear of snow and inspects and inventories his gear soon after arriving in the mountains.



Three of the four observers and their shelter. They are (left to right) Lt Dave Kelly, LCDR Dick Ritz, and Mr. George Banky.

ready told you what actually happened.

At this point, LTJG Doody was taken to the NAS Lemoore SAR helo which was waiting to take him and four observers to a preselected site in the High Sierras. Unfortunately, weather conditions precluded inserting anyone on that day, so the entire operation was postponed until the day following. This negated some of the shock factor but did not help LTJG Doody much because his flight gear was impounded. This gave him no chance to procure extra food and clothing.

The refusal to allow the chosen pilot "survivor" to add extra clothing to his gear tied in directly with the major reason for the exercise—a desire to illustrate the need for pilots to wear adequate protective clothing when flying in a winter environment.

Prior to the start of the exercise, Barn Owl pilots had been briefed to wear long underwear and winter flight suits whenever they were scheduled to fly over the Sierras. As is usually the case, some of the pilots were content to be more comfortable in the cockpit in their summer flight suits. Of course, cockpit comfort is nice to have, but it certainly was small comfort to LTJG Doody on the following day when he and the four observers were airlifted to a meadow at the 8000 to 8500-foot level in the High Sierras. With a temperature ranging in the low 30s, with 4 to 5 inches of snow on the ground, LTJG Doody's summer flight suit was essentially valueless. He was allowed to don waffle weave long underwear, but even this did not help very much.

On reaching the meadow, LTJG Doody was left to his own devices while the observers constructed their shelter. Although somewhat confused initially about where to start and what to do, LTJG Doody soon began a logical survival sequence.

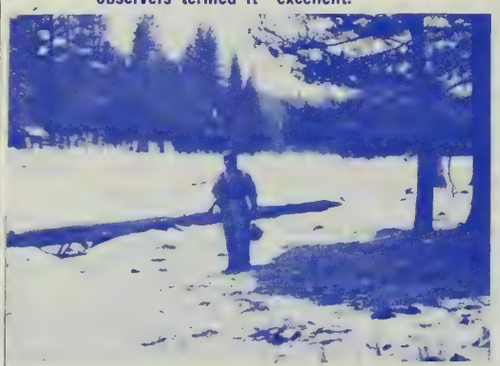
First, he selected a spot relatively clear of snow and took stock of his gear. In addition to his survival vest and LPA, he was given a parachute, a liferaft, and the contents of a seat pan. After completing his equipment inventory, he searched for a site for his shelter. He selected a "V" formed by the trunks of two large, fallen trees. The shelter he constructed was excellent and as comfortable as possible under the circumstances. By the time he finished his shelter, the sun had set, and the temperature had begun to drop.

During the early evening, he continued to prepare the inside of his shelter. Despite his relatively light clothing, he was able to stay relatively warm by keeping busy.

At approximately 2045, jet aircraft were heard overhead. Using a



The "survivor" puts the finishing touches on his shelter, built between two fallen trees. The observers termed it "excellent."



Temperatures dropped to 24-26 degrees during the night, but LTJG Doody was warm and comfortable.



You can barely see LTJG Doody bundled up inside his shelter.



LTJG Doody spent a comfortable night in his shelter, although observers were very uncomfortable.

PRC-90 radio, preset to an exercise frequency, he made contact with what proved to be two VA-215 A-7Bs returning from a night mission. For the next hour, he conducted a mini-SAR exercise. He practiced vectoring the aircraft to his position and also tested his night signaling devices. Upon completion of this, both he and the observers prepared for sleep.

Meanwhile, the temperature was falling to the mid-20s. This temperature drop and LTJG Doody's extreme discomfort presented an excellent opportunity to test a mountain survival suit known as the Bugaboo Mountaineering Sierra Kit. At 2200 the observers gave him a kit.

The suit, made of synthetic fabric and goosedown, consists of a jacket with hood, gloves, trousers, and body bag. Added attractions from a Navy/survival point of view are its bright orange color and its size when packed. The entire outfit can be hand-packed into two cylindrical bags approximately 8 inches long and 4 inches in diameter. When the suit is vacuum-packed, the size can be cut in half. (The Air Force has tested and evaluated this suit but there are no present plans for procuring it.)

This Sierra kit enabled LTJG Doody to pass the night very comfortably even without a sleeping bag. The observers, outfitted in long underwear, summer flight suits, standard issue winter survival suits, headgear, and gloves, were quite uncomfortable during the early morning hours even with sleeping bags.

The exercise ended the following afternoon when the NAS Lemoore SAR helo "rescued" LTJG Doody and the observers. Before the exercise ended, however, there were several opportunities for further training —which included conducting SAR support exercises with VA-215 aircraft during both day and night conditions and testing night location aids.

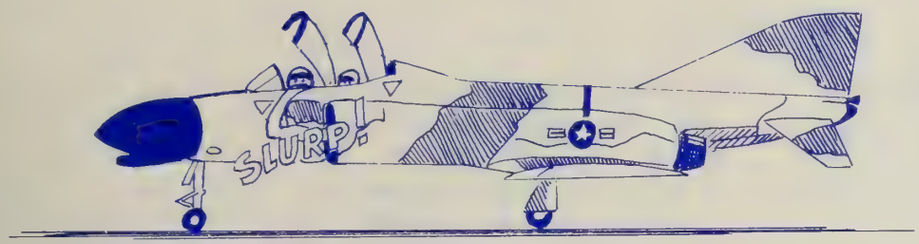
The exercise brought to light many pointers and hints for the individual pilot who might find himself in a winter mountain survival situation. Most of these are SOP. Many are not followed. Any one of them could mean the difference between life and death—your death.

- First, and most important, follow the Boy Scouts' motto and "Be Prepared." Wear proper clothing when conditions dictate it. In a winter situation, consider taking along an extra pair of heavy socks, a good pair of winter (waterproof) gloves, and some kind of ski cap or watch cap.
- Don't count on being rescued the day you eject. Many factors—chief among them the weather—can prevent this. Consider carrying extra food such as beef jerky or candy.
- If you do find yourself in a winter mountain survival situation, be logical. If you have time, inventory your gear, but keep in mind that your primary and immediate objective is a decent shelter. All other things can come later.
- Don't exhaust yourself. Working at high altitudes is different from working at low levels, so conserve your energy by pacing yourself.
- Remember that a fire can be one of your most important assets. It can provide warmth as well as become an excellent night visual pinpoint. VA-215 SAREX pilots reported that they could see LTJG Doody's fire long before they came within radio contact range.
- Lastly, be cool. Most aviators consider themselves Sierra Hotel gents in the air and about town. Maintain that attitude in a survival situation, and you will be miles ahead.

The choice of whether or not to consider these basic elements of survival is the pilot's. But keep in mind LTJG Doody's words when questioned about the value of adequate protective clothing: "How strongly do you feel about life?"

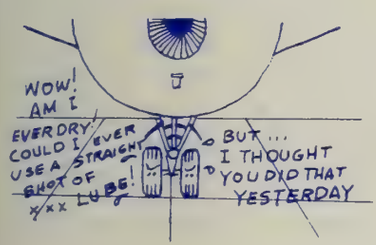
Reprinted from *Approach*. ★

who goofed



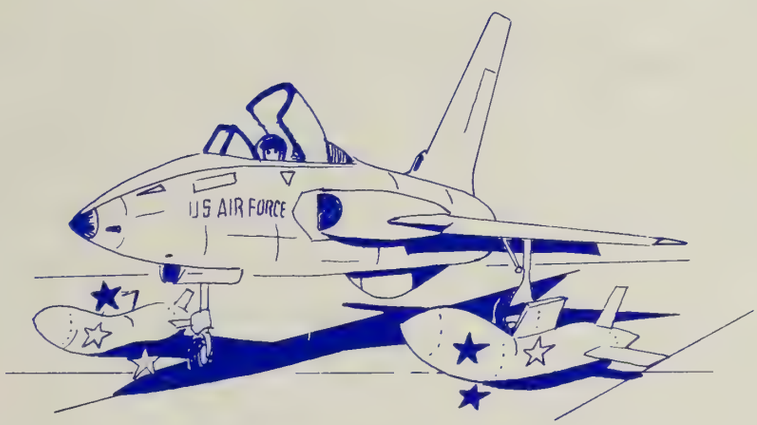
While the F-4 was parked in the de-arm area, the pilot pulled the face curtain safety pin out of the pin stowage bag and installed the pin in the ejection seat. The pin bag with the remainder of the pins was then put on top of the seat for taxiing to the parking area. As the aircraft was turned to the right leaving the de-arming area, the pin bag fell off the seat. The pilot was able to catch the bag before all the pins had dropped out of the bag. He then briefed the ground crew at the parking area about a pin falling out. The ground crew installed the safety pins, and all the pins were accounted for but one. The crew chief immediately checked the intake area and there it was—pieces of the red streamer in the left intake area. The engine was removed and inspection found minor FOD throughout the compressor and on the first and third stages of the turbine wheels.

no lube no gear



The KC-135 pilot was performing his descent checklist. When he tried to put the gear down the nose gear would only show an intermediate position. The crew had to lower the nose gear manually. During post flight inspection, the nose gear was found dry from improper lubrication. After 10 man-hours and proper lubrication, the nose gear retraction tests were completed without malfunction. By the way, the servicing records showed that the nose gear had been lubricated the day before the incident (?).

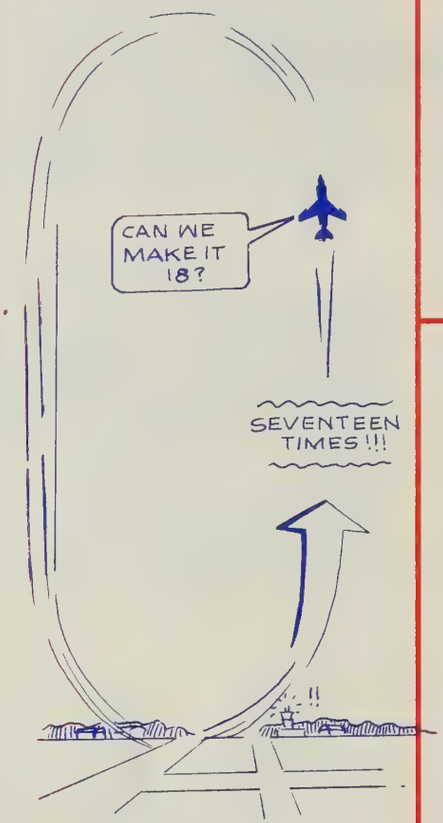
mum is a bummer



The crew chief of an F-105 that had returned from a flight installed down locks and safety pins, but . . . since he was unable to find the pins, the 450 gallon fuel tanks weren't pinned. Shift change came around and he was relieved of duty. He hadn't found the tank pins yet and forgot to tell his relief or supervisor of the missing pins. Later when the new technician who had come on duty left the aircraft to get a set of BPO cards, the load crew arrived and started installing a centerline MER and adapter. When they got to the pylon jettison check, two 450 gallon fuel tanks were dropped on the ramp. No one knew about the missing pins. The aircraft forms were at debriefing.

tech topics

dragging

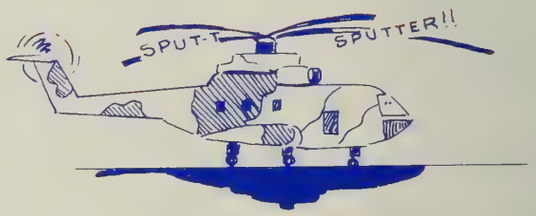


The F-4 was on landing roll when the aircraft started veering to the right; however, the pilot was able to keep it centered on the runway with nose wheel steering. Troubleshooting revealed the lock plate for the adjusting ring had been left off when the right wheel was rebuilt. During the previous 17 takeoffs and landings, the bearing adjusting ring backed off allowing the right wheel and tire to come free from the bearing cone sleeve. This also allowed the wheel to move inboard and rotate on the disc drive keys causing severe gouging.

cockpit FOD

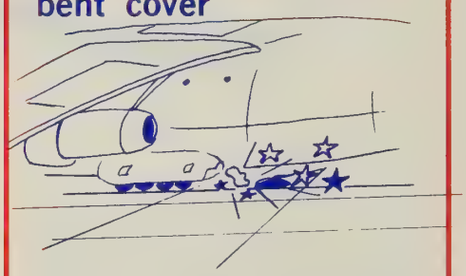
The T-38 made an emergency landing because the pilots couldn't move the stick more than ¼ of normal travel aft. When they checked the aft stick well, the pilots found an instrument floodlight cover. It didn't take much investigating to find where the floodlight cover came from. It was from the front cockpit and had worked its way back under the instrument panel to the aft stick well. The missing cover was not entered in the forms and neither the crew chief or the pilot noticed that it was missing during their pre-flight.

no fuel



A CH-3 pilot was preparing for a training mission. The pre-flight was normal through engine start. When the rotors were engaged and fuel boost pumps were turned off, fuel flow for nr 1 engine dropped to zero and the engine flamed out. Inspection found the drain cock in the fuel filter was cocked partially open by a small piece of O-ring in the drain cock. With the drain cock partially open, the engine driven fuel pump was able to draw air into the fuel system.

bent cover



The C-5 was being marshalled into the parking spot. During taxi, the left main landing gear traveled over a fuel pit cover. A deficiency in the pit cover allowed it to raise causing damage to the aircraft brake hydraulic lines and the pit cover.

believe it!



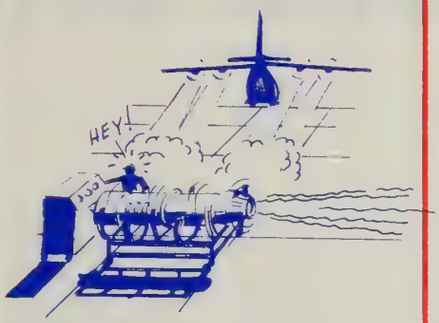
We've heard some crazy things but this is near the top of the "I don't believe it list." A C-130E was leaking fuel, so the bird was towed into the fuel cell hangar for repair. To pinpoint the source of the leak, the fuel tank had to be entered. Good thing. The guy in the tank found four large pillows that the aircraft had been hauling around.

loose pin



While on a single ship training sortie, the F-4 pilot encountered a fire warning light on the left engine. The engine had to be shut down to extinguish the light. There were no discrepancies in the fire warning loops or connectors. However, the engine technician found a hot air leak and removed the engine for detailed inspection. During the inspection, the technician found that the alignment pin for nr 9 combustion can was not properly installed. The threads on the pins were stripped; however, the boss wasn't damaged. There had been no work done on the engine in this area since the engine arrived from overhaul. Wonder where the inspectors were when it came time to check the can?

no communication



The specialist team was assigned to run an engine for an ops and stabilization check. All the pre-run checks were correctly performed, and the team started the run. The engine was running at military power for the stabilization check. The engine operator was concentrating on the engine instruments so he didn't see the C-130 taxi to a position about 50 yards from the test cell. The C-130 was parked tail to the test cell and then the crew started a high power engine run. The blast from the C-130 propellers struck the test cell at about 40 knots. This wind caused the engine on the cell to twist severely in the mounts. The operator tried to shut the engine down but the throttle control lever was jammed when the engine twisted. It took him several tries to free the lever and shut down the engine. But before he could, the engine had run out of control for 30 seconds or more and had experienced both an overspeed and overtemp. A little communication between the test cell and the C-130 operators would have prevented a mishap like this.

hot start



The F-4 aircraft was scheduled for a cartridge start. Nr 1 was started and all indications were normal. As nr 2 was started, the crew chief reported there was a Fire in nr 2 engine bay. Fire equipment responded and quickly extinguished the fire. Investigation disclosed a cracked oil line allowed oil to feed the fire during the cartridge start. ★

MAIL CALL

continued from page 28

This speed decrease is insidious because it happens without any sense of deceleration since the groundspeed tends to remain constant unless the throttles are changed. A pilot intent on visual cues during the last part of the approach may not notice the airspeed suddenly bleeding off which would result in arriving in the landing zone out of airspeed. With a strong headwind for example, it's not uncommon to lose airspeed below touchdown speed prior to landing flare.

The best protection against the headwind shear is to develop safe habit patterns such as a good look at airspeed about 200 feet above touchdown. If the airspeed is just starting to decrease, moving the throttles forward slightly will usually accelerate the airplane to maintain indicated airspeed. Since shear is so common, it's best to expect it and plan to counteract it on each approach if it shows up.

JAMES M. DIEHL, Lt. Col, USAF
KC-135 CFIC Instructor
Carswell AFB TX ★

MAIL CALL

The October issue of *Aerospace Safety* was welcome as always. I read each issue for information useful in the SAC Central Flight Instructor Course. I enjoyed the article *Landings—Good and Bad* but I feel that the wind shear discussion is partly incorrect and misleading.

Wind shear causes a change in airflow around an airplane faster than the momentum of the plane can change to adjust to the new flow unless definite changes of thrust are applied promptly. Wind shear can affect an airplane from any direction; vertically or horizontally—either from the side or fore and aft. Vertical shear on final could feel like an updraft or downdraft which would cause a ballooning above or sinking below the glide slope and would be recognized quickly. Horizontal shear fore and aft would not accelerate the airplane forward or backward due to the airplane's mass and clean frontal profile but would be registered as a change of relative wind or indicated airspeed. A decreasing headwind would register as a decreasing airspeed and decreasing tailwind as an increasing airspeed. This probably would not be noticed as easily since the glide slope would remain unchanged while only the indicated airspeed would change.

The article suggests that wind shear affects the groundspeed when it actually affects the indicated airspeed. The term wind shear in the article is used as if it were a steady tailwind or steady headwind. A steady tailwind approach has a fast groundspeed while a steady headwind approach has a slow groundspeed. The rapid change of wind caused by a shear changes indicated airspeed without giving the ground speed a chance to change and stabilize. The groundspeed does tend to change, but its amount of change is negligible for the short time available on final approach (about 30 seconds from 200 feet to touchdown).

Given the example of a tailwind on ILS which changes to a headwind, the flight path angle doesn't change as the article suggests. The glide path angle is fixed because the airplane travels the fixed gradient or angle of the glide slope. The vertical velocity changes, however, with ground speed. A tailwind approach is hazardous as many unfortunate pilots have discovered for years but not for the reasons in the article. Instead of steep glide angle and low thrust resulting in a short or hard landing, the airplane will have the exact opposite hazard. When a tailwind suddenly becomes a headwind the indicated airspeed will suddenly increase resulting in excessive float, long touchdowns at high speeds with a need for even less power. Both the float due to the shear and the high groundspeed due to the steady tailwind prior to the shear make stopping the airplane difficult.

Most landings are made into the wind which gives the airplane the advantage of slower groundspeeds for touchdown and stopping. However, if the headwind stops abruptly, the airplane is exposed to the hazard of a hard landing unless it can accelerate to a safe indicated airspeed. Vertical shear or "downdraft" can force the airplane to drop off the glide slope faster than it can climb which would result in landing short of the runway. If the headwind shear and vertical shear happen together (as they often do), the hapless pilot finds himself in the jam of losing altitude and airspeed at the same time. This is probably what happened in the Air Force accident 200 feet short of the runway and the DC-9 accident mentioned in the article.

Vertical shear can be caused by rising warm air followed by descending cool air or "thermals." A common example of this is at Hickam when approaching over Barbers Point, then the entrance to Pearl Harbor then the overrun of Honolulu International runway. Vertical shear can also be caused by mechanical disturbance of air flow due to terrain or obstructions. Updrafts and downdrafts near buildings, cliffs and canyons such as at Offutt or Guam act like miniature mountain waves.

The vertical shear caused by a thunderstorm is the most violent and easily avoided—don't fly near thunderstorms.

The horizontal shear is the most common yet least suspected of all wind hazards yet it wasn't mentioned in the article. Horizontal headwind shear is the most common cause of hard landings especially when no other explanation is obvious such as a duckunder. Some flight manuals discuss it by its technical name, wind gradient, instead of by its common name wind shear. Wind speed is usually higher above the ground than near the ground due to frictional drag of the air mass with the ground surface. The runway wind can be 10 knots while the wind at 200 feet on final can be 30 knots for example. This is the situation facing the pilot on nearly every landing. Unless power is added, the indicated airspeed drops off due to the headwind dying off. continued on page 27

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outstanding airmanship

and professional

performance during

a hazardous situation

and for a

significant contribution

to the

United States Air Force

Accident Prevention

Program.

Captain
James R. Polizzo and crew
514th Military Airlift Wing
(Associate) AFRES
McGuire AFB, NJ





L-R, TSGT JOHN G. FINLEY, FE, MAJ JERALD M. DAVIS, NAV, CAPT EDMUND ROSSNAGEL, PILOT, CAPT JAMES R. POLIZZO, AC, CAPT MARIO A. CINQUINO, PILOT, SMSGT DAVID P. MOSKOWITZ, LM, SSGT JOHN A. BLACKLEY, LM, SGT ROBERT N. PARILLO, LM, MISSING, NOT IN PICTURE: MAJ FRANCIS D. DUGAN, NAV (732 MAS), TSGT PERVIOUS A. CLOSE, FLIGHT ENGINEER.

Captain Polizzo and his crew departed Torrejon AB, Spain, for McGuire AFB, NJ in a C-141A. The weather was good and all was normal until the aircraft reached 1500 feet AGL. Then there was a loud bang and the aircraft yawed to the right. The gages indicated a problem with nr 3 engine and at first it was thought that the nr 3 thrust reverser had opened; however, the auxiliary navigator had just installed the sextant and could see that the nr 3 engine cowling had come off and lodged on the leading edge of the right wing. The scanner, meanwhile, reported smoke, fuel mist and damage to the engine, wing and inboard wing flap. Captain Polizzo declared an emergency, requested clearance to Torrejon at 5000 feet MSL to jettison fuel. After a controllability check in which no control problems were noted, Captain Polizzo made a successful approach flap PAR approach and landing. After the aircraft cleared the runway, it was stopped, engines shut down with fire handles and all passengers and crewmembers evacuated. Captain Polizzo and his crew prevented a serious inflight emergency from becoming a possible disaster. Their performance reflects great credit on them and the US Air Force. WELL DONE! ★



NEW MAGAZINE COMING

Airman Michael J. Valenta and TSgt Harry Gethers of the 35 FMS, George AFB, get a sneak preview of the new Maintenance Magazine.

"MAINTENANCE Magazine," a new Air Force quarterly for aircraft and weapons maintenance technicians is about to be launched. Scheduled to hit the field this February, the 64-page magazine tackles a broad range of subjects related to aircraft, missile, and weapons system maintenance. All material is designed to interest and encourage the aircraft and weapons maintenance technician to do his job safely and effectively.

The tone and style of the five-by-seven, two-color magazine reflects its orientation to the younger airman. As with DRIVER Magazine, bold imaginative layouts are used along with numerous photographs. A majority of the articles will be written by maintenance people in the field, and the editors plan to keep the magazine closely attuned to the interests and concerns of the young readership.

As a result of the specialized orientation of MAINTENANCE Magazine, distribution of AEROSPACE SAFETY Magazine is now limited to aircrews and others directly involved in flying operations. Comments, suggestions, and ideas related to the new "MAINTENANCE Magazine" are welcomed. Contact AFISC/SEDA, Norton AFB, CA 92409, Autovon 876-2633.

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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FEBRUARY 1976 AFRP 127-2 VOLUME 32 NUMBER 2

Safety In '76

When our aircraft accident figures are all compiled and the books are closed on 1975, many people will conclude that we had a good year. By comparison with 1974 and the past several years, we did; but when accidents cost the lives of 43 Air Force pilots and 221 other military people and more than $300 million in equipment destroyed, as they did in 1975, we can't spend much time congratulating ourselves. We can and must do better, but it will take the most professional and concentrated effort all of us can put forth.

There are many factors we must identify, isolate, and correct. They fall into two basic categories—people and hardware. Historically about 50 percent of our accidents are people-caused—either as the sole factor or as a contributor. These are not new cause factors. The large majority have been clearly recognized over the past 10-15 years. In fact, they have been talked about so consistently that they sound like trite phrases and entreatments rather than very real mistakes.

Aircrews in some cases were guilty of gross violations of discipline. Some just did a poor job of flying and others didn't follow established procedures.

Supervision caused or contributed to far too many accidents. We saw no new errors in supervision but, almost without exception, those that were made have been highlighted and talked about for as long as I have been flying.

Although it is nearly impossible to pin down the exact number of accidents caused or contributed to by maintenance, poor design or unresponsive modification programs, we know the number is significant, and that many of these problems have been with us for years. Now how do we attack them in 1976?

We have already begun to put together a long range, coordinated effort stressing safety research, human factors analysis, and evaluation and improvement of training.

A major goal is to improve our ability to identify and analyze past data, so that we can take action to prevent accidents rather than react to them. In doing this, we must be sure we are collecting the right data and making proper use of what we collect. We haven't done this adequately or very successfully in the past.

New systems frequently incorporate old problems. We hope to counter this by improving design criteria, so that we do not keep repeating the old mistakes, and by concentrating to a greater degree on system safety engineering.

Statistically we may have shown some improvement in the numbers of accidents during 1975; however, in terms of combat capability lost, which may be irretrievable in today's economy, we must do much better in 1976.

We must do the job right, from the ground up whether it be designing new hardware and weapons, scheduling our missile or aircrews, or performing the overhauls and unit maintenance required. Too frequently this past year we have seen the band-aid approach to problem solving. We need to identify root causes to our problems and correct these, perhaps to the exclusion of other more visible and appealing fixes.

I'm convinced we have more capable and dedicated people in the Air Force today than we have ever had. The challenge is here for all of us, whatever our level of assignment or area of endeavor. We must and can maintain an Air Force second to none —that is our goal this year at the Directorate of Aerospace Safety.

Richard E. Merkling

RICHARD E. MERKLING, Brig Gen, USAF
Director of Aerospace Safety

OPS

let there be light!

The KC-135 boom nozzle light failed in flight. Despite the fact that the lack of light limited his ability to see the area behind the receiver F-4's air refueling receptacles, the boom operator attempted to complete the air refueling. In the process, a combination of receiver movement and the boom operator's inability to see resulted in the loss of three upper TACAN antennas and damage to a fourth on the receiver F-4s.

F-111 fire warning control unit

The F-111 experienced a left fire warning light shortly after takeoff. The crew accomplished the proper checklist procedures and made an uneventful recovery. The fire warning light was caused by a faulty fire warning control unit. The top of the unit had been dented. This probably occurred when a crew member stored some gear under the seat.

a real surprise

The copilot of the C-5 was executing a planned breakaway maneuver after completion of air refueling. However, he inadvertently placed all four throttles in reverse instead of just the inboards. All four thrust reversers went into reverse without effort. The AC immediately placed the outboard throttles in the positive thrust range and all reversers retracted normally. Review of the maintenance data recorder shows that only nr 4 engine actually went into reverse. The cause was the failure of the reverse thrust lockout actuator.

right idea wrong button

As the O-2 pilot pulled off a marking pass he tried to contact the fighters. But he pushed the pickle button instead of the mike switch. The rocket impacted 5 "clicks" away, but luckily still on the range and caused little damage.

smoke screen

The T-37 IP had just completed starts on both engines when he saw the crew chief pointing to the right engine. When he looked over his shoulder, the IP saw greyish smoke in the nr 2 engine exhaust. He immediately shut down both engines. The smoke dissipated during shut down and maintenance could find no discrepancies. The aircraft subsequently flew without incident. Discussion with the pilot indicated that there had not been a large volume of smoke, but since he had never experienced smoke during start, he wisely elected to shut down the engines and let maintenance investigate. It is a characteristic of the T-37 engine that if an engine is shut down quickly from a relatively high power setting, insufficient scavenging of oil from nr 2 bearing can occur. If this oil does not completely burn away but pools in the engine there will be oil smoke during the subsequent engine start.

aircraft strobe lights

The general officer panel on midair collision potential has determined that aircraft strobe lights contribute significantly to the reduction of midair collision risk. The panel has directed AFSC to take immediate action to start development of strobe hardware specifications.

barriers and antennas

Barriers are still biting aircraft antennas. A VHF antenna was knocked off a C-141 by a bouncing cable.

TOPICS

big wind

The A-7 was returning to parking. The pilot saw an A-10 running up in an adjacent parking place. Thinking the A-10 was at idle, the A-7 pilot proceeded to taxi behind the A-10. Unfortunately the A-10 was at about 85%, and before the A-7 pilot could close his canopy it departed the aircraft. As a note, the A-10 ground crewman saw the A-7 too late to advise the A-10 pilot to reduce power.

"guard" means just that

An F-4 pilot was very embarrassed when he tried to land gear up. Many pilots have tried this trick. That's one of the reasons RSU officers check configuration. In this case, the RSU observer did check the configuration and directed a go-around three times on Guard. The pilot did not hear the Guard transmissions because earlier he had turned off his Guard receiver. Luckily, an alert controller in the tower made a transmission on the tower primary frequency and prevented the mishap.

overstress

As the F-101 raised the gear after a practice missed approach, the aircrew heard a loud sound. The gear indicated unsafe and this was confirmed by a tower fly-by. The crew used the emergency extension system and then made a successful landing. The nose gear attach and beam assemblies had failed. This failure is possibly the result of overstress from exceeding gear limit speed on previous flights.

hazard reports

A USAF aircrew flying in the Mid East received clearance to descend which did not provide adequate clearance. The crew recognized the erroneous clearance and there was no problem. However, the crew waited almost a month to report the hazard. This delay unnecessarily endangered other aircraft and precluded any realistic investigation or corrective action. If you are involved in a mishap that should be reported as a hazard, do it as soon as possible. You might prevent an accident!

ARTC

The FAA has introduced a system which will alert controllers to potential conflicts between aircraft above 18,000 feet. The computer program projects what the flight paths of aircraft will be in the next two minutes. When these projected flight paths exceed the required horizontal or vertical separation minimums the data tags on the display begin blinking, alerting the controller to the possibility of conflict. This system is operational in 20 of the centers in the CONUS.

F-4 double generator failure

Right after lift-off the F-4 yawed and the DC bus light came on. The crew accomplished the emergency checklist for double generator failure. Another F-4 joined on the emergency aircraft and led it to a straight-in final for a successful approach end engagement. Maintenance found the electrical test receptacle cap under the right canopy sill in the rear cockpit was loose. When this cap was properly tightened both generators functioned perfectly. This unit has submitted an AF Form 847 to include checking the test receptacle cap security in the double generator failure checklist. ★

LANDING.



LT COL JOHN P. HEFFERNAN, Directorate of Aerospace Safety

Most pilots are good at getting it up but when it comes to getting it down, landing that is, it seems we're still on the learning curve. Space won't permit a reiteration of the errors we've made in all types of flying machines; so, since the fox four fleet is a large one, let's pick on it and contemplate some of the things which have happened to others but "will never happen to us."

(1) The aircraft was returning to base after a night range mission with weather reported as 500 and 2 with light snow showers and fog. The first PAR approach resulted in a go-around near decision height, and the second PAR, with weather at 400 and 2, ceiling ragged, resulted in another missed approach. Had enough? The pilot elected, with the concurrence of the SOF and DCO, to try again before diverting to an alternate. The third approach was normal until 2.5 miles on final, when glide path deviations became significant. The GCA controller directed a missed approach; however, the aircraft struck the trees and the crew ejected safely.

(2) Lead and his wingman had split up after their gunnery mission. Lead had returned to base and was in the GCA pattern when the runway was closed for emergency barrier engagement. The wingman heard of the emergency and diverted to a nearby base. Lead stayed with GCA and attempted to determine the runway condition. Fourteen minutes later, with his fuel below divert minimums, lead diverted. He took the long route to jettison his tanks, and acquired his divert runway at 8 miles with about 1000 pounds remaining. The approach was a steep, descending turn downwind to prevailing traffic. The landing was hot and touchdown was 7000 feet down the runway. The aircraft passed over the barrier before the hook could deploy, and departed the end of the runway at approximately 180 knots. The crew ejected safely.

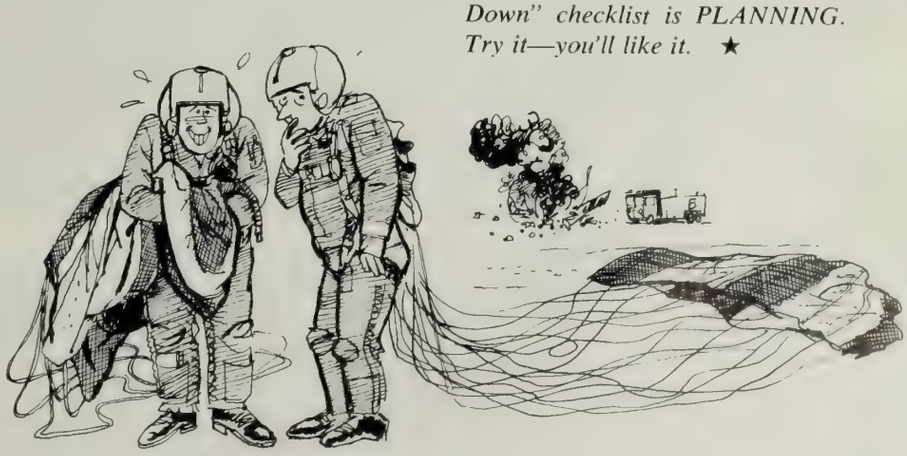


GETTING IT DOWN

(3) During a local theater orientation mission, the pilot was cleared for a TACAN approach which included an altimeter setting departing FL 180. However, the approach contained flight level restrictions which delayed resetting of the altimeter. Radio problems were encountered, but clearance to FL 040 was obtained and contact with local radar was accomplished. The arrival controller did not give an altimeter setting and the pilot did not ask for one. The approach was continued with 29.92 set in, instead of the actual setting of 29.52. Gear check was accomplished, and 35 seconds after departing the FAF, the aircraft crashed in an open field at a normal rate of descent. Again, the crew ejected safely.

(4) The pilot, on a day ferry flight to home base, was cleared for a TACAN penetration and approach, and contact was established about 8 miles out on final. The landing clearance was given at 5 miles; the approach was continued to a smooth touchdown without gear or flaps. It slid about 5000 feet. The crew egressed safely.

These are but a few examples which point out there is more than one way to get down. All the aircrews escaped injury, and three of them ejected at ground level. Whether you have the luxury of riding a hot seat or not, it would seem rational to consider how you come back to mother earth. The first step in the "How To Get It Down" checklist is PLANNING. Try it—you'll like it. ★



STOPPING / ON THE RUNWAY

CAPT GARY A. VOELLGER
523d Tactical Fighter Squadron
Cannon AFB, New Mexico



Most aircrew emergency training emphasizes the idea of "getting it safely on the ground" when things go wrong in flight. I could hardly dispute this concept, but I sometimes think we don't pay enough attention to what happens between landing and the time the aircraft is stopped. Inflight emergencies such as those involving single engine approaches and no flap configurations or BLC malfunctions traditionally dictate greater than normal approach and landing speeds. Volumes have been written on aircraft approach and landing techniques, and aircraft flight manuals generally devote considerable verbiage to this stage of flight. In contrast, the intimately related and equally critical aircraft braking phase is often given cursory coverage, usually by reference to a multi-lined chart hidden somewhere in the aircraft limitations or performance data sections. But let's face it, safely stopping a 150- to 200-knot tricycle on a skinny strip of runway is a full blown emergency by itself.

Having been on that ride a time or two myself, I was prompted to do some research into the problem. For the sake of brevity, there are many factors involved in high speed braking that won't be addressed here. However, I would be remiss to entirely neglect mention of them, so to stimulate your thinking in this area, here are a few of the more important ones: rubber deposits on the runway, residual lift after touchdown, antiskid system effectiveness, tire condition, runway condition, gradient and RCR. A comprehensive explanation of all the contributing factors in high speed braking would require a book rather than a magazine article. Therefore, I have selected what I consider the key fac-

continued



tor to the whole problem, *kinetic energy* and its dissipation.

In mathematical terms kinetic energy, in foot pounds, equals one-half the mass times the velocity squared ($KE = \frac{1}{2}MV^2$). Since the mass (weight of the aircraft) remains relatively constant, the variable we deal with during landing is velocity (V) or the aircraft speed. To graphically explain the effects of kinetic energy I have taken a model landing and broken it down to show the dissipation of kinetic energy vs. the dissipation of groundspeed.

At point A the aircraft touches down, and both groundspeed and kinetic energy are at 100% values.

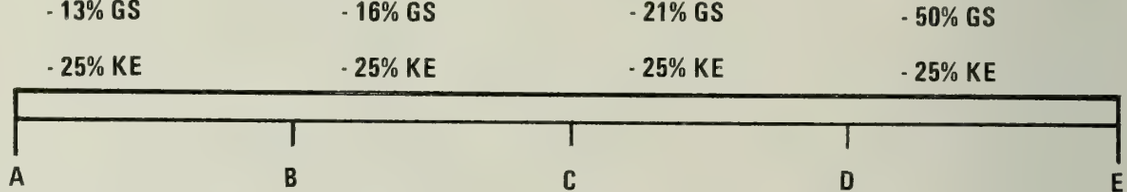


CHART 1

At point B, 25% of the kinetic energy has been dissipated, however 87% of the groundspeed still remains. At point C we have dissipated 50% of the kinetic energy and only 29% of the groundspeed. Finally at point E we have completed our full stop, 100% of both kinetic energy and groundspeed have been expended. What does all of this theory mean to you the pilot?

Well, as the graph illustrates to even the most casual of observers, kinetic energy is dissipated at a somewhat constant ratio. In contrast, groundspeed dissipates exponentially. In layman's terms, this means that high speed, initial attempts to brake have little effect on groundspeed. But then as groundspeed begins to decay, it does so at an increasing rate. You might say: "The slower you get, the faster you get slower." The statement is grammatically confusing but it pretty much sums up the theory behind kinetic energy.

Because of this phenomenon, the landing roll can be highly deceptive. During the initial stages of an abnormally high speed landing roll, the runway markers flash by at a seemingly steady rate, the groundspeed remains nearly constant and one begins to feel as though he is executing an 8000 foot landing roll on a 7000 foot runway. This is the point when many of us might panic, stomp on the binders and burn up the brakes or blow a tire. Why? Because of kinetic energy. All of that stored energy has to be spent on some form, usually as heat.

The amount of energy required to just barely sense the deceleration of a 40,000 pound aircraft at 140 knots (i.e, "I just checked the brakes to see if they would work) is more than that required to slow the aircraft from 55 knots to a full stop. Where does that put you and me during a high speed landing roll? You're right, in the proverbial "high profile spotlight" unless it is handled properly. To do that I would suggest a few tips:

1. CHECK THE CHARTS—Even if you can't do it in the aircraft, get the SOF or RSO to look at the dash one charts and find out how much of a landing roll you'll need (don't assume perfect conditions). Then check the brake energy charts for the airspeed at which you can start braking for your specific gross weight. As an editorial tip, it's a good idea to be generally familiar with this chart all the time.
2. LAND ON SPEED—Remember that the landing roll energy is increased by the square of the velocity.
3. USE ALL OF THE RUNWAY—Particularly the first part. You can't begin stopping until you are firmly on the ground.
4. KNOW WHAT TO EXPECT—Realize how and where the kinetic energy dissipates. Remember that the groundspeed intially dissipates very slowly and then at an ever increasing rate.
5. DON'T FORGET THE BARRIER—Don't be so engrossed in stopping that you neglect the barrier as an alternative braking device. It's one heck of a lot better to be explaining how you ended up in the barrier than explaining why you ran off the runway. The only thing worse than not knowing what to do is knowing what to do and letting pride prevent you from doing it.

STOP SAFE!!! ★

PASSENGER ASSISTANCE IN EMERGENCIES

LT COL ROBERT J. BRUN, Directorate of Aerospace Safety

The number of USAF aircraft which are fully equipped for carrying passengers has been steadily declining for several years. As a result, most of our mass nontactical personnel moves are handled by contract carriers. However, our support flights still sustain a significant volume of passenger traffic and our cargo/tanker fleets double as personnel carriers when required. As opposed to our sophisticated C/VC-types, these aircraft do not have passenger address systems, equipment information cards in the seatback packet, or passenger-oriented emergency equipment.

The larger planes generally have a loadmaster or other crewman dedicated to passenger care; but in the small birds, the service available may be limited to a flight mech who loads bags, hands out box lunches, and checks seat belts. For experienced passengers, and under normal circumstances, this may be sufficient; but at the onset of an emergency, the passengers' needs multiply rapidly.

Passengers seldom remember even the cardinal points in the preflight briefing, and experience has shown that persons under stress may not comply with instructions without direct, forceful language or physical urging. This was again confirmed in a recent incident involving a commercial aircraft on a military charter flight.

A brake fire during ground operation resulted in an order to evacuate. In spite of instructions given in the briefing and repeated over the PA system as the evacuation was being carried out, some passengers failed to use only the primary exit evacuation slides and were injured when they attempted to egress through overwing exits. In a more serious situation, this could have been fatal.

In another large aircraft mishap, the sudden loss of cabin pressure created a seemingly low stress requirement to use the passenger oxygen system. A postflight review of the passengers' reactions revealed that less than 5 percent of them knew how to use their masks, and some of these did not fully understand how to start and maintain oxygen flow once they had the mask in place.

These experiences should serve as a warning to aircrews and their supervisors that an aircraft emergency involving passengers creates an immediate demand for supervision and assistance. Gaining confidence and establishing control are among the initial problems an aircrew member faces, and it is hard to project confidence when you are unsure of your own ability to cope with the situation. In short, you must know what to do and do it right the first time. A strong positive aircrew reaction to an emergency can be the key factor in preventing panic and establishing passenger confidence.

While passenger confidence is built on trust, aircrew confidence is built on knowledge. Here is where the challenge to crew members and supervisors comes into play. Our aircrew training and qualification standards have to meet and exceed anticipated emergency situations. This is where the outcome of passenger-related emergencies is decided. Even though passenger supervision and assistance may be a secondary duty for some aircrew positions, the passengers' lives are literally in their hands when an emergency arises. Individual aircrew members, their evaluators and supervisors have a solemn obligation to insure they are the most skillful and dedicated hands that can be provided. ★



HANGAR FLYING

MAJOR JOHN R. SPEY
475 ABW
APO San Francisco



Twenty years ago if we pranged a bird it could cost our life and a few hundred thousand dollars. Today the dollar cost of an accident is staggering, apart from the tragic loss of life. What's the answer?

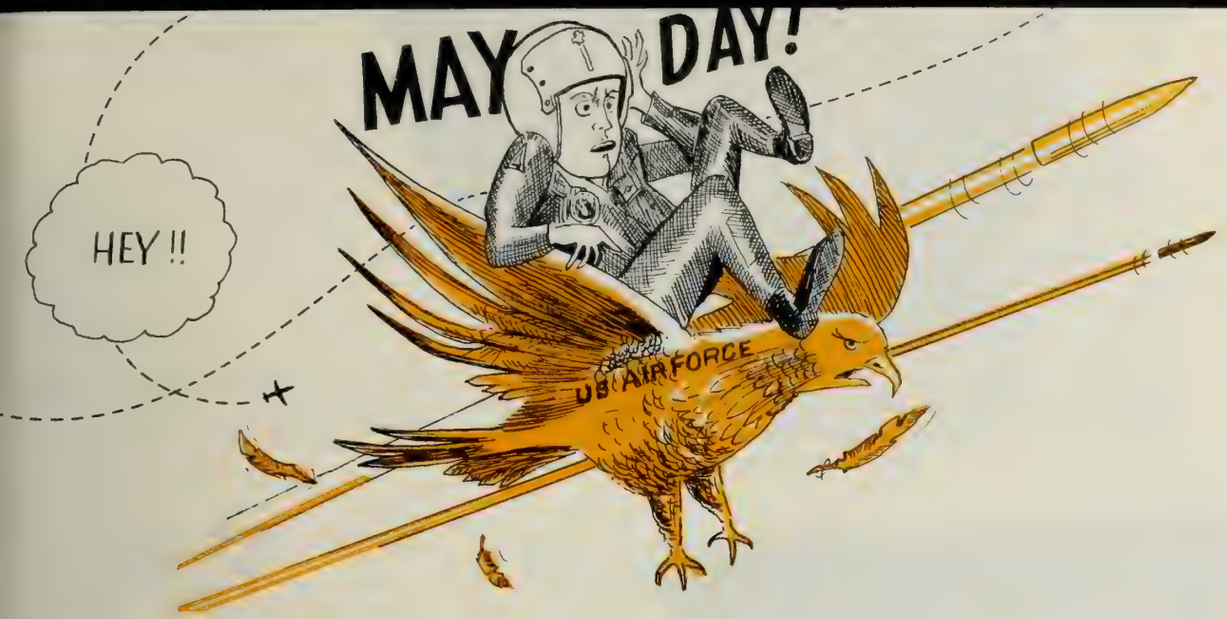
Our leadership has endorsed and encouraged safety, stan-eval and training programs. These programs have had a positive effect but still we have accidents. Today there is less flying time for you and me. As a result there is less time available for our flying proficiency. The fuel crises, inflation and budget cuts have seen to this. Given the circumstances of fewer hours, younger pilots and the unchanged (and still demanding) flying environment, the accident rate could get worse.

The solution for achieving a lower accident rate rests somewhere and that is with you and me.

Did you ever see a bird have an accident? Can you remember seeing a bird land on a tree limb "gear up?" Did you ever see him land short or have a midair with a buddy?

A bird is born into the flying game. He solos early in life and the sky is his environment, his home. On occasion he'll ram an unseen window, a speeding automobile or an airplane. But given his natural environment, his accident rate per flying hour must be regarded as pretty remarkable. He survives a darting dash through a dense bamboo thicket and flies flawless formation in unforgettable flocks. In poor weather, low VIS and VFR, without instruments, doppler or inertial, he gets his job done. His environment is always hostile. He must constantly be on the alert for bandits ready to bounce him even while in the chocks. In spite of all these problems, his performance as an aviator is inspiring and led man to join him.

Since our fledgling days at Kitty Hawk, we as pilots have attempted to leave our natural environment and join the eagles; most have been successful, but many have



failed. If we pilots are to adapt to the sky and survive, we must aspire to be an eagle; a true aviator.

Ancient Polynesians, with a highly trained sense of observation sailed across seemingless endless ocean to make landfall without aid of compass, sextant, or chart. Those skippers were *totally involved* in their problem; their minds completely tuned to the mission. Anything less could and often did result in disaster.

How many times is our preflight planning performed to fill the squares? Our mental effort directed toward the administrative process, toward making sure the system is satisfied. What we may fail to do is to quietly, personally digest the data, scramble it with our mission and "day dream" the flight.

Day dream, you say! Yes, day dream. Think the flight through alone—at home—quietly; just you. Give it a complete mental review. So much for the normal mission. Now give yourself an unusual occurrence. What was your solution? Create an emergency situation. Solve it mentally and critique yourself. Don't worry if your first reaction was not the best; nobody is listening. This process is just between you, the pilot, and you, the aspiring eagle. Was the corrective action appropriate for the circumstances created? If not, think it through again.

The process of mental "Hangar Flying"; mentally preflying a sortie, complete with emergencies, can sharpen our knowledge. Getting mentally involved in flying, doing our own personal "Hangar Flying" and giving ourselves a private Stan-Board is one way to stretch the shrinking flying hour and gain experience.

We have all marveled at the calmness of the "old head" who, while in the pitch, calmly advises the tower he's flamed out and has a fire light, and requests permission to land, with the same everyday tone and tempo he might use praising his daughter at home. He's been there before and it's no surprise. He is mentally involved and prepared.

Several years ago, while in my apartment, I "daydreamed" a sortie to be flown the following day. I created a situation where both engines were damaged while on a low level mission. I mentally took the best action under the circumstances, all in the quiet of my living room. The following morning the totally unexpected happened. At 100 feet above the ground the right engine suddenly stopped from a lucky AK-47 round; 15 seconds later the left engine received a dose of the same. Total mental chaos? Not quite!

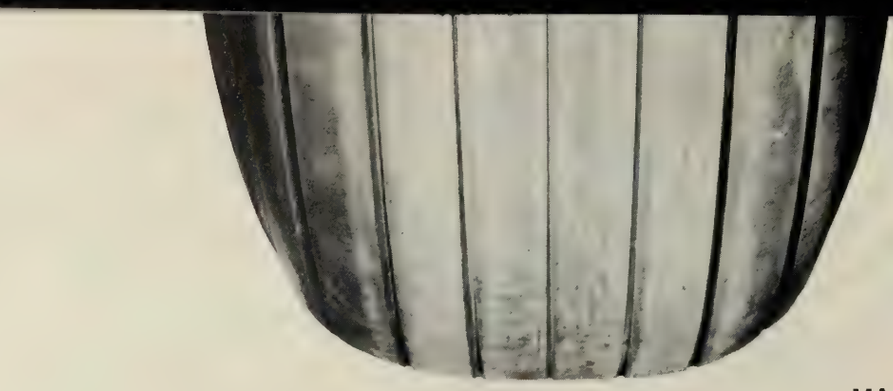
My action, previously rehearsed, exploded from my subconscious and permitted me to convert near disaster into a happy ending. When I think back on that and other incidents, I'm convinced there would have been chaos in my mind and my cockpit, and emergencies encountered then and since would not have been handled as satisfactorily without prior rehearsal at home or privately in my own "hangar."

Flying safely is everyone's job but in the final judgment it is ours. We long to join the eagles but in so doing, we leave our environment for their's and we'd better be prepared. "Hangar Flying" is one aid. ★



ABOUT THE AUTHOR

Major Spey enlisted in the Air Force in 1956, attended A & E school and served as a mechanic for two years prior to entering the aviation cadet program. Since graduation from pilot training he has acquired 6700 flying hours, including 3500 hours IP time and 1100 combat hours. Most of his experience has been in the C-123 and he spent 3½ years with the Ranch Hands flying defoliation missions.



MAJOR THOMAS R. ALLOCCA
Directorate of
Aerospace Safety



HE HIT A WHAT?

"... The right main landing gear struck a highway 'YIELD' sign. . . ."

In the 1920s when the Waldo Pepper types were terrorizing the countryside as they flew down main street between the old general store and the town post office, accident narratives like this were fairly common. So, if you guessed that the opening statement was extracted from an accident report narrative, circa 1924, you could not be accused of making a bad guess. But, this highway "yield" sign was not struck in 1924—it was hit in 1975!

The accident sequence states, in what has to be the understatement of the year, ". . . he flew a shallow approach which failed to provide obstruction clearance. . . ."

The point of all this rhetoric is not to indict some poor chap, who, like many of us, may have suffered a momentary lapse of judgment and had to suffer the inevitable consequences; no, the point is that we have to be aware of the all-too-human tendencies to occasionally fracture the rules and disregard due caution. And each of you concerned with flying safety—commanders, crew members, flying safety officers, crew chiefs; in short, everyone—must be aware of this tendency and its concomitant result—that occasional lapses of judgment are going to come up and bite you on the _____!

Is this an isolated incident?



Tree branches are not recommended for engine inlets.

Did I extract this mishap narrative from the thousands in our files and portray it as representative? Read on.

". . . Upon return from a crew training mission, an enroute penetration was made followed by radar vectors for a visual approach and landing. The pilot turned base leg at approximately 4 miles at a VFR pattern altitude of 1400 feet MSL and rolled wings level on final approach at 900 feet MSL. He said that he discontinued the approach when he encountered a rain shower on final. Postflight investigation revealed that tree branches were in the engine inlets. . . ."

And on . . . ". . . Bull 18, returning from a local continuation training mission, began the pilot proficiency portion of the mission after a full-stop, taxi-back landing. After the first approach, Bull 18 advised Metro that some local fog was moving in which might affect airfield visibility. Advisories were issued that fog obscuration would affect approximately one-half of the 12,000 feet of runway 06. Bull 18 requested radar vectors to a visual approach for 06. During the approach, the aircraft descended to the point where trees were struck 3 miles from the runway . . ."

And on . . . ". . . Seth 84 was on a return flight for a passenger pickup. The airfield weather was deteriorating with scattered to broken clouds at 1500 feet and visibility of 5 miles in haze. A Tacan straight-in approach was flown because GCA was inoperative. One and one-half miles from the end of the runway, the pilot noticed that the aircraft was getting low—the tree-tops were illuminated; power was added and a climb initiated. Postflight analysis revealed that some slat damage resulted when the aircraft struck the top of a tree. . . ."

Okay, you have had enough. But think. In the short span of 23 days, we had 5 separate incidents involving aircraft hitting trees, yield signs and other such foolishness. Fortunately we lost neither crew members or aircraft; but it requires little imagination to develop a scenario wherein any one (if not all) of these mishaps could have resulted in a tragic accident. So we have been lucky.

What caused these incidents? It is difficult to point to one cause common to every mishap, but this "type of finding" crops up in every instance: "A Command regulation specifying that an approach should be flown to position the aircraft 50 feet over the runway threshold *was not complied with.*" or "A VFR approach was flown to an airfield reported to be below weather minimums in violation of AFR 60-16."

The antics of the Waldo Peppers and the excesses of which they were guilty fostered upon modern aviators the stream of regulations with which we now live. These directives, conceived by aviators far more perceptive than you and I, are designed to make us fly safer—and live longer. Can we afford *not* to follow them? Hardly!

In the 1920s, airplane costs were measured in the hundreds of dollars; in the 1970s, the costs are many times as great. In the 1920s, the "barnstorming" approach to airmanship may have been condoned; in 1975, it's intolerable. ★



The only comment for this is "Lucky Pierre!"

From Whence We Came

BIGGS FIELD, TEXAS

CIRCA 1920-22

Biggs Field, a part of Ft Bliss, in El Paso, Texas, during the early 1920s was the home of the intrepid flyers of the 12th Observation Squadron and their Curtiss "Jennies" and DH's. Created during World War I, this rough and tumble outfit was one of a handful of units engaged in military flying during the lean years following the war. Its rolls were rich with the spirit of flying pioneers that helped form today's Air Force.

We are interested in presenting an ongoing pictorial documentation of the history From Whence We Came. We were fortunate to get these shots of that bygone time from a man who was actually there. We hope that you, too, may have some knowledge of historically interesting photos of other times and places and will contact us. All photographs would be carefully handled and returned to sender after use. Please call AUTOVON 876-2432 or write AFISC/SEDA, Norton AFB CA 92409.



The officers and pilots of the 12th Observation a varied array of uniforms.

The CO of the 12th Observation Squadron, proudly accompanied General John J. ("Black Jac an inspection of his troops. Note the full fie men. They were still a part of the Army and able to shoulder a rifle, march, and live in the



In an early version of AF open house they conducted a race between two wingless aircraft, the Spark Plug and the Damfino (dam-if-I-no). It is reported that there was heavy betting among the spectators and some hard feelings when the leading aircraft, Damfino, tried to take off and skip along the ground, thereby blowing the victory. Knuckle sandwiches were traded off behind the hangars as the wagers were settled.

During the open house 1st Lt Claire Chennault, d guised as a little old lady, took an "aeroplane" ri The watching crowd was horrified when the plane fl by inverted and Chennault threw out a dummy from open cockpit.







fore one of their fragile craft, a Curtiss JN-4 "Jennie", in



Brig Gen Billy Mitchell (left) visited Biggs Field often during the period after World War I. Later he was to achieve immortality through his prophetic insight and dogged pursuit of the advantages of air power. Because of command resistance, which led to his demotion to colonel in 1925, he pressed for his own court martial to gain public attention. Convicted, he retired and fought for his beliefs until his death in 1936, scant years before they were amply proven in the skies of WW II. For his sacrifices, in 1942 Congress awarded him a special medal of honor but, contrary to popular belief, he was never posthumously promoted to major general. As late as 1957 Secretary of the Air Force Douglas concurred in the findings of the court martial. On USAF rolls he remains to this day a retired colonel.



'Nuff said.

With mountains to the north, east, and west it became common practice for "lost" pilots from Biggs Field to fly south across the border into Mexico. There they would land and seek help from friendly natives.



FROM WHENCE WE CAME continued



The field exercises held for one month each year made the spartan Biggs Field seem like living at the Ritz.



Almost every kind of aerial activity visited the field during these years. Blimps were viewed as a promising area of research. The building at right housed the mess hall where they served spaghetti by the mile.



In windy West Texas, handling blimps was often a matter of luck and manpower above skill. This blimp was later destroyed when it brushed against a building and caught fire.



Between WW I and WW II the flying corps and the cavalry were both considered to be elite services. There was a curious contrast during this brief overlap period as the horse was passing into history and pilots were beginning their reach for the stars.

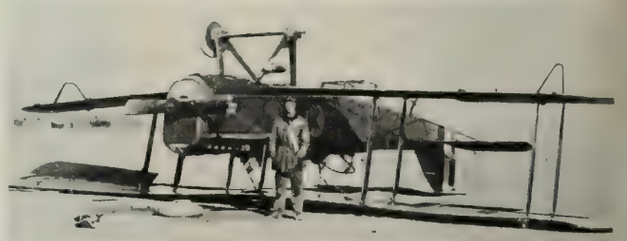
Those were the days of trial and error flying. Even so, this (right) was stretching it a bit far.



"Old Leatherface," in leather hat and jacket, Gen Claire Chennault of WW II Flying Tiger fame shares an earlier day as a 1st Lt with his fellow pilots of the 12th O.S. The dogs were a common item at Biggs Field where almost everyone had one.



There were no more valuable men to the pilots of the 12th than the stalwart mechanics who kept their craft in flying condition (some things have never changed). These are a few of that hardy breed leaning on their gasoline truck.



A TRACE OF DISASTER

LT COL ROBERT J. BRUN
Directorate of Aerospace Safety

Details released by the National Transportation Safety Board on two winter takeoff accidents illustrate how dangerous "a little bit" of frozen precipitation can be.

In the first example, the aircraft was a light four-place single engine recip. The pilot's attempted takeoff with two passengers ended in a plowed field 700 feet past the field boundary. Results of the investigation indicated the plane rolled the full length of the runway before becoming airborne, climbed about 20 feet, then stalled and crashed. Fortunately all of the occupants survived.

Two hours after the accident, investigators inspected the wreckage and found the upper wing surface completely covered with a jagged layer of ice up to half an inch thick. The ailerons and empennage control surfaces were partially covered to an equal degree. In his post-accident interview, the pilot stated that he noted ice and snow on the aircraft during the preflight but did not do anything about it since he had taken off "lots of times" with ice on the wings

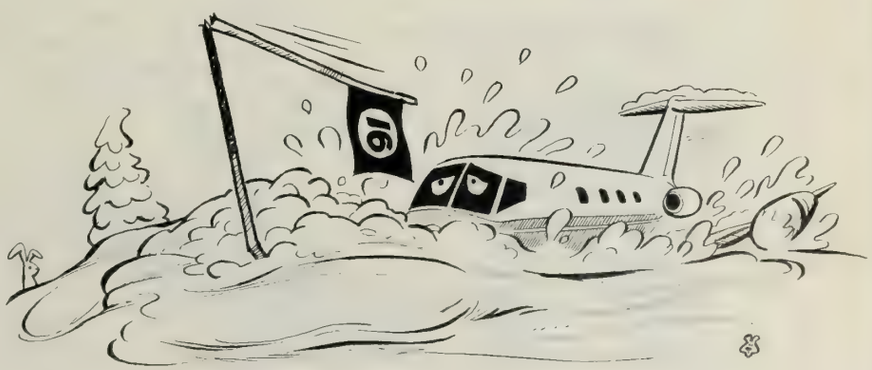
The second accident involved a twin jet similar to our T-39, with an air transport pilot at the controls and a copilot plus seven passengers rounding out the list of occupants. The pilot called for taxi clearance at 1645 and was advised to expect a 20 minute delay. They were cleared to taxi at 1750 and the takeoff roll began at 1805. An excerpt from the weather at that time period including "indefinite ceiling, visibility one-fourth mile in snow showers, temperature 33 degrees." Part of the delay was spent on the ramp during which the pilot said he deplaned and brushed off some of the snow which was accumulating on the aircraft. He emphasized that it was not sticking to the metal. A ramp area witness reported there was more than an inch of wet snow on the aircraft as it passed his position.

The pilot reported the takeoff was normal until he began to rotate, and the aircraft did not feel right so he aborted. Failure of the drag chute and snow on the runway resulted in an abort distance which exceeded the runway available. The excesses included a light fixture that marked the end of the paved surface, the field boundary fence, and a 1,000-foot divot in the golf course which adjoined the airport. Once again the good earth bordering the runway was instrumental in preventing serious injuries.

In their summary, the Board pointed out that despite the difference in equipment, pilot qualifications and experience, these two accidents shared the same basic cause—an accumulation of ice and snow on the aircraft which was not removed prior to commencing takeoff. Also cited was the statistical record of the 1970 through 1974 takeoff accidents involving airframe icing. There were 58 such mishaps, and they accounted for 62 personnel injuries and 27 fatalities. The 12 persons involved in the accidents described above came closer than they realize to joining these lists in the latter category.

Winter operations require some special safety precautions. Among these a careful preflight should be a primary consideration. The Board issued some advice and a warning to cover this situation: "It is an aerodynamic fact-of-life that adherence of ice or snow to an aircraft can change the lift and drag values to a point where it can impair controllability and even make it impossible to obtain or maintain flying speed . . . and such accumulation should be considered a no-go item."

Remove the snow before you go! ★



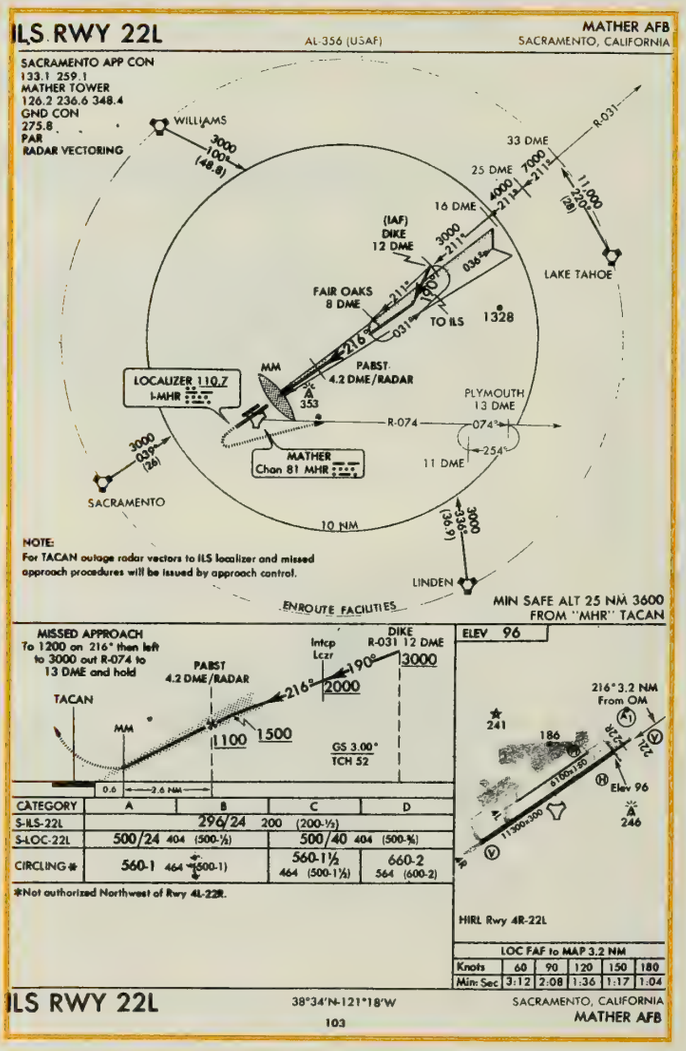
THE IFC APPROACH

ILS OUTER MARKERS

An old NAVAID is slowly but surely fading away. The Air Force has directed, where possible, the decommissioning of outer markers as a cost reduction measure. Locations which have the capability to provide a radar and DME fixing capability at the final approach fix, are phasing out their outer markers.

What effect will this have on flying instrument approaches? Either radar or DME will be required to locate the final approach fix (FAF). For those aircraft without DME, air traffic control radar will inform the pilot when the aircraft is over the FAF. However, if radar is the only available means to identify the FAF, use radar only procedures and file an alternate. An example of this type of approach is depicted on the instrument approach procedure chart shown in Figure 1.

FIGURE 1



MIDDLE MARKERS

Some confusion seems to exist as to the purpose of the middle marker on an ILS or localizer only approach. Normally, the middle marker is *not* used to identify minimums for either of these approaches. However, it may be used as an aid to alert a pilot that he is near decision height on an ILS.

The middle marker may also alert the pilot that he is at or approaching the localizer-only missed approach point (MAP). Compare the distance shown in the timing block to that shown in the profile view. In Figure 1, the localizer-only MAP is located 3.2 NM from the FAF. Looking at the profile view, you can see that 3.2 NM would place the aircraft 0.6 NM inside the middle marker and over the runway threshold. Timing is the primary means of locating the localizer-only MAP on this Mather approach. As mentioned earlier, a blinking marker beacon light is a good alert that you are nearly there.

The point to remember is that you must study an approach thoroughly prior to flying it. Never assume, just because a middle marker is shown, that it identifies the missed approach point.

FINAL APPROACH STEPDOWN FIXES

Q: May an aircraft without dual NAVAID receivers fly an approach which depicts a stepdown fix that is located inside the final approach fix when the fix is formed by a crossing radial from another facility? (Figure 2 is an example)

A: Yes, but descent below stepdown fix altitude is limited to aircraft capable of simultaneous reception of final approach guidance

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

and the stepdown fix. An aircraft equipped with a single VOR receiver would not be able to descend below the stepdown fix altitude of 2000 feet at Kelly since that fix is formed by two VOR radials. To help alleviate this problem, many aerodromes have published radar stepdown fixes which are depicted in a manner similar to the Radar Final Approach fixes discussed earlier. Using approach control radar to identify the stepdown fix will enable aircraft equipped with a single NAVAID receiver to descend to the lowest published minimums. Remember that final approach course guidance must be continuously displayed after passing the final approach fix.

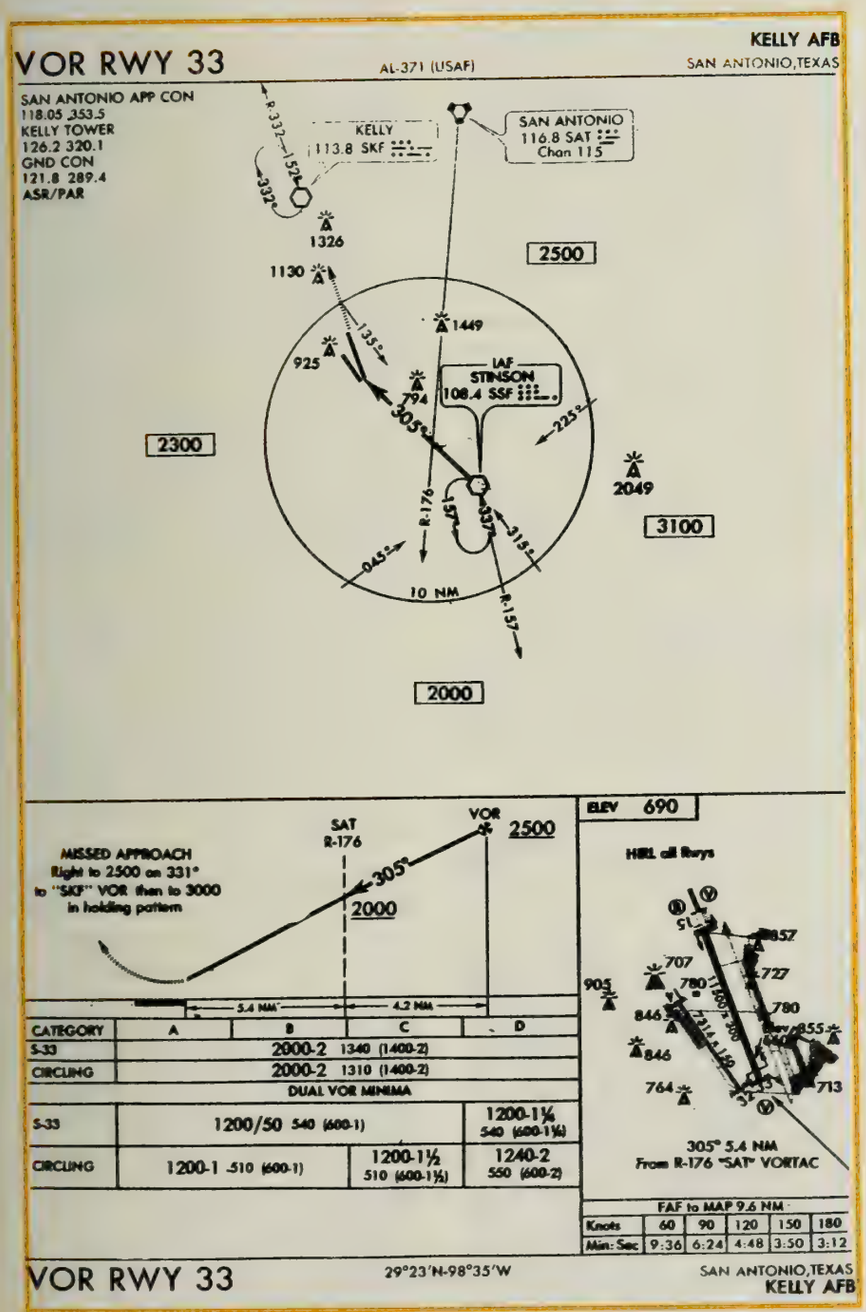


FIGURE 2

The USAF Instrument Flight Center encourages questions and suggestions regarding instrument flying. Comments from our readers are used to write "IFC Approach" articles and to clarify the various regulations affecting instrument flying. Call or write USAF Instrument Flight Center/FS, Randolph AFB TX 78148; AUTOVON 487-4276/4884. ★

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

of heart attacks

ANCHARD F. ZELLER, PhD, Directorate of Aerospace Safety

A 55-year old pilot collapsed and died of a heart attack while flying on a check flight. Two more very short paragraphs of this obscure news release, buried in the body of the newspaper, indicated the individual was an airline pilot, that there were no passengers, and that the plane landed safely.

That's too bad you say, but so what?

That couldn't really happen to me, I'm an Air Force pilot. Maybe it could happen to some of the old guys, but I'm young, combat ready, just had my three-year physiological training and my annual physical. The worst thing I ever get is a little cold or maybe a slight stomach upset after an extended attitude readjustment session. No problem, right? —wrong. Just read on.

During a climb through 9500 feet, the student felt light headed and thought the aircraft was in a roll and diving. Actual attitude was wings level in a slight climb. The IP took control of the aircraft, declared an emergency, and landed safely. Post-flight medical examination showed that the student had infections in both middle ear canals.

Ah, you say, a student. Now don't insult me. Students aren't too bright you know. He probably had a little pain, hyperventilated, and got all shook up. Happens lots of times to students.—Well let's try again.

During the initial climb, the cabin pressure would not go above 1000 feet. Manual control was selected and cabin pressure increased to 5000 feet. The system was returned to normal and functioned as designed for the rest of the flight. Two hours later during descent, the navigator — the NAVIGATOR? — yes, the navigator, complained of having difficulty clearing his ears. The aircraft was passing 10,000 feet at the time. The pilot notified the controlling agency and slowed his descent. On the basis of communications with the flight surgeon, the aircraft was climbed from 3000 to 16,000 feet and the cabin pressurization was brought to 16,000 feet. Various positions and methods for clearing his ears were tried by the navigator as recommended by the flight surgeon. All were unsuccessful. Following a slow descent and landing, the navigator was evacuated to the dispensary. Examination indicated inflammation and fluid behind the left ear drum.

First an old airline pilot, then a student, and now a navigator. It doesn't seem to me your examples are very persuasive.

Well, read on. But let's deviate a little from colds for a minute.

The aircraft was nr two in a flight that was scrambled from an alert facility in response to a request for tactical air support. The WSO flew the aircraft most of the way to the tanker where the aircraft commander took control. His control was erratic and illogical. He attempted several rolls as if he were attempting to dive bomb. Each time the WSO assumed control before the maneuver became dangerous. The aircraft commander then called Lead saying, "The ball game is over." He initiated a dive from 20,000 feet which could have been fatal if the WSO had not again assumed control and pulled out at 4000 feet. From thereon, there was a battle to see who could control the aircraft with the aircraft commander making 3 or 4 more dives toward the ground. On the return toward base, the aircraft commander repeatedly stated his intention of landing on the runway "about five miles ahead." There was no runway. After an attempted gear-up landing, which the WSO aborted by again taking control of the aircraft, the gears and flaps were lowered and a successful landing made. After landing, the pilot was given a psychiatric examination. Not surprisingly, he was diagnosed as having had an acute schizophrenic reaction.

Poor guy, you say, he'd just been through too much. Shouldn't have been pushed so hard.

What about the WSO?

Well, what about him? Besides, we were talking about colds and things like that, not the stresses and strains of combat.

So, let's talk about colds some more.

The Nr three pilot in a flight of three on a day, low-level training, navigation mission, started a pullout from a 40-degree dive. The pullout appeared successful but in that attitude there was not enough altitude for recovery. The pilot ejected at about 150 feet. He and the seat struck the ground seven feet apart, 127 feet from the point

and belly aches

(FOR PILOTS ONLY)

of aircraft impact. The parachute was approximately one-half open. The pilot was killed. His left glove and clip board were found with the aircraft canopy 150 feet before the impact point. The pilot had suffered from an upper respiratory infection for about 10 days prior to the accident. He was confined to bed for three days, treating himself with aspirin, an inhalant, and other medication. The autopsy indicated an inflamed and blood-filled middle ear and evidence of inflammation in the trachea and bronchus. The position of the left glove indicated that it had been removed prior to the crash, probably, to get his hand to the left ear or to valsalva to relieve a severe pain due to a middle ear block. The pilot was probably not in control of his aircraft for a period of 5 or 10 seconds and realized his precarious position too late.

Closer to home? The only difficulties you ever have are a little cold or a stomach ache? Let's talk about the stomach aches.

During the past 48 hours the student had had some symptoms of abdominal discomfort, with loose and more frequent bowel movements. He had not been acutely ill and his appetite had remained good. He had had three bowel movements in the 2½ hours prior to flight. Conditions were normal throughout the pattern work, but on the way to the work area, symptoms of increased abdominal pressure occurred passing through 19,000 feet. These were not relieved by belching or the M-1 maneuver. The student did, however, perform the spin prevention and two good spin recoveries. When the IP directed the student to return home, he got no response. The student was holding his hand to his stomach while the aircraft was descending in a shallow turn, apparently unnoticed. The student was unresponsive, appeared in pain, and was, in the opinion of the IP, incapacitated. The IP took the aircraft home. The student recovered uneventfully.

We're back to students and the dumb things they do, you say.

Come on now. Do we have to go through this whole thing again to get you to admit what you really know and, that is, that even you very skilled and experienced pilots take chances too?

OK, so you agree that sometimes you do stupid things, you still contend, however, that that example of the airline pilot was a little farfetched. Let's check.

While flying at 8000 feet, the center called out a target at 11 o'clock low to the pilot. The pilot, copilot, and flight mechanic looked in that direction. The flight mechanic spotted the other aircraft and pointed it out. The copilot acknowledged that he had seen it. When the pilot was asked why he had said nothing, he turned his head and raised his right hand. He appeared to be having a stroke. The other crew members were called forward and moved him to the back of the aircraft. Attempts to revive him were unsuccessful. An emergency was declared and the aircraft landed at the nearest suitable field. He was pronounced dead on arrival at the hospital. Cause: a coronary occlusion.

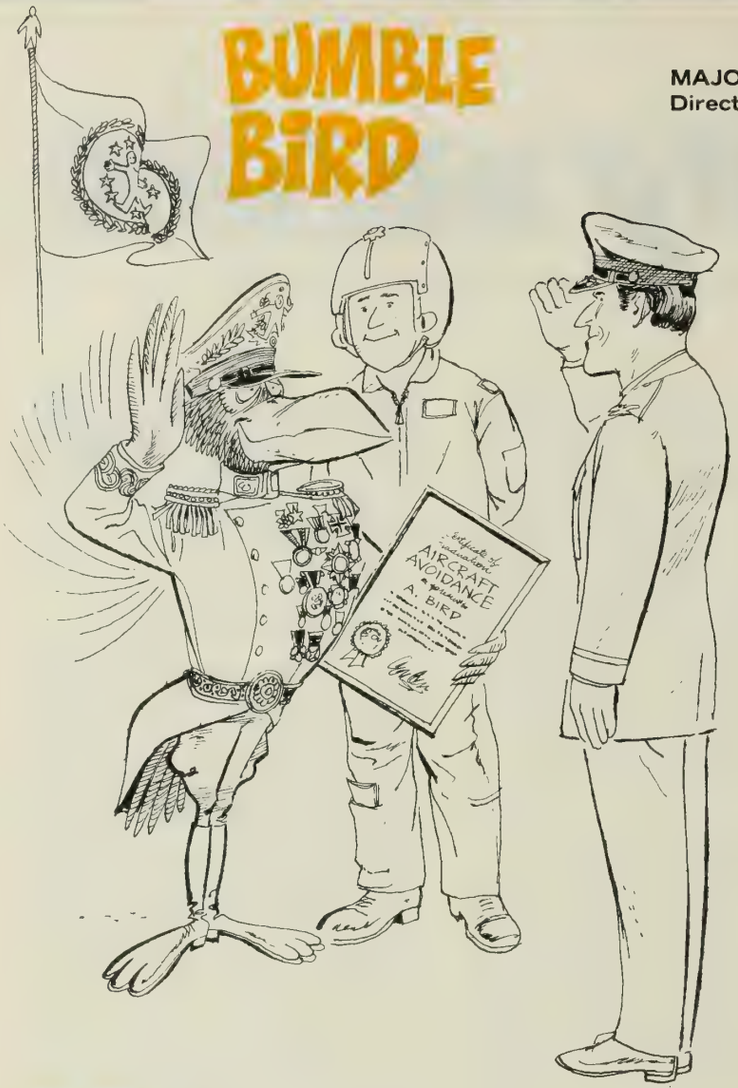
Fortunately, this was a multiple crew aircraft and the remaining members, reacting as they should, made it possible to document the cause. Sometimes this isn't the case. How many accidents in which the cause cannot be determined because of total disintegration or because the aircraft is lost over water are the result of some form of pilot incapacitation? No one knows for sure.

So you're shaken a little. Let's level with each other. Sure your chances of having a fatal heart attack aren't great. But, by your own admission, a few colds and an upset stomach, perhaps even a headache or two, aren't all that uncommon.

In these times when flight time is so hard to come by, it sure would be a shame to have to scrub a flight just because of a sniffle or pain in the belly. Maybe you could take the chances with a little self-medication (no reason to let the flight surgeon know) and make it. Thousands have—but some haven't. The cases cited, all real, are only a few of many, many examples. One shouldn't dwell on the morbid. It's not healthy. On the other hand, if you ignore the realities of experience, it really can happen to you too. ★

BUMBLE BIRD

MAJOR TONY HELBLING, JR.
Directorate of Aerospace Safety



Maybe we can learn from our "feathered flyers" when it comes to "crashology." Birds, like pilots have a learning curve! The average bird "graduate" approaches this survival plateau after one year. During this one-year period, a young bird must master at least three specific areas:

- Lookout Techniques (Check Six)
- Intercepts
- Advanced Maneuvering

A "graduate bird" can spot a fat bumblebee at R_{max}, positively identify him as a food source, calculate his vector, velocity and plot an instantaneous intercept with a break-away heading. A "smart bird" such as this one is usually a "big bird." A high skill probability (P_t) results in a proportionally high protein intake. We, here at the Safety Center have designated this large, smart graduate bird as "friendly." He is awarded an "Aircraft Avoidance" Diploma with a red, white and blue seal.

This seal certifies our "Wonderful Winged Warrior" as a friend of American airpower and encourages him to maintain this degree of proficiency so as not to degrade the combat capability of friendly forces through an inadvertent "BIRDSTRIKE."

On the serious side, there are a few things we have learned about birdstrikes: The birds who learn and survive the first year will probably never strike an aircraft. Some birds such as the red-tailed hawk reside in the vicinity of airdromes and are constantly in the pattern with fighters and jumbo jets. They know how to identify turbulence hazards and how not to intercept something larger than themselves (avoid collisions). They have a high exposure *and* higher success rate.

They possess a simultaneous computer-like sense of staying clear of multiple aircraft. Some studies show birds involved in aircraft strikes are for the most part young. What can we do as pilots?

- Landing lights help and we think strobe lights do too. Turn 'em on! (Even young birds have figured out that bugs and bees don't have landing lights!!)
- Certain birds prefer specific altitudes. Know your local birds and their habits!
- The chances of a birdstrike on a low altitude route are good. Since the energy generated (damage) during a birdstrike increases with the square of the velocity, it makes sense not to go any *faster* than you need to at low level for training purposes.
- 3-lb bird at 300 KTS = 11,974 FT/LBS of SMASH
- 3-lb bird at 500 KTS = 33,262 FT/LBS of SMASH

Big difference, huh?

Not all birds are born equal!! Some are truly BUMBLE-BIRDS! For whatever reasons, they'll look at an F-4 and think it is an airborne bug . . . , or, never check six and be run over by a C-5 . . . or, maybe not be up to speed on hard-defensive maneuvering such as an "aircraft break" (equal to a SAM-BREAK for birds).

Birds, like people sometimes have bad days (got up on the wrong side of the nest!) . . . or, ate a bad berry for breakfast . . . or whatever!

Keep the eyeballs out of the cockpit whenever possible!

Don't forget! An airborne object which has *no relative motion* with respect to your aircraft is on a *collision course!*

BEWARE OF STUDENT BUMBLE-BIRDS! ★

FLYING 'N DYING

LT COL JIM LEARMONTH
Directorate of Aerospace Safety

Sufficient time has passed for us to discuss the loss of comrades in aircraft catastrophies. As all things are significantly clearer viewed from the security of the headquarters, the tendency to critique persists.

Since 1969, five A-7Ds have flown into the ground while practicing air-to-ground ordnance delivery—three in 1975. All of the pilots involved in these accidents lost their lives. All of these mishaps involved dive angles of less than 20 degrees and most occurred after the recovery maneuver.

In our past attempts to prevent these types of accidents, minimum recovery altitudes have been raised, maximum dive angles restricted to low angle events, plus any number of briefings and rebriefings,. ad nausem. Apparenty to no avail.

Have we, then, investigated all possible avenues to try to save the lives of A-7 pilots? Today at the Oklahoma City ALC, a further study of the ADI system is expected to provide the pilot with an active system malfunction warning device to supplement the power on/off indication presently available. This move may prevent a spatial disorientation episode, compounded by unreliable attitude information from turning into a sod buster.

But, attitude indicators and instrument failures are not my concern. Are you, the pilots of the wonderful, one-heart one-seat Corsair, doing your part to save your own derriere? In three of the accidents mentioned, the radar altimeter was found set at 100' ± a few. Well, sure that keeps the low altitude warning light from causing a lot of tension in the cockpit during takeoff. But, couldn't we make time to reset it to the minimum recovery altitude prior to the range mission? ★

ENROUTE WEATHER SERVICE

MAJ HERBERT WEIGL, JR, HQ Air Weather Service (MAC), Scott AFB, IL

Air Weather Service (AWS) places great emphasis on providing assistance to those responsible for protecting Air Force resources on air bases and in the airspace immediately around those air bases. AWS has not been able to provide comparable service to aircraft outside of the terminal area simply because the means to do so were not available.

Concern over the deficiency has resulted in a joint AWS, National Weather Service (NWS), and Federal Aviation Administration (FAA) test that is directed toward helping enroute aircrews avoid hazardous weather. A small weather forecasting unit has been established in the Kansas City Air Route Traffic Control Center (ARTCC). The forecasters use FAA radars, pilot weather reports (PIREPs), and weather radar reports to better identify weather hazards such as thunderstorms. They monitor the ARTCC's jet routes and vector airways affected by thunderstorms, icing, or turbulence. They issue advisories to the ARTCC controllers who, in turn, relay the advisories to aircrews approaching hazardous weather areas. The forecasters operate a unique pilot-to-metro service (KANSAS CITY METRO) on Channel 369.9 capable of responding to calls from any part of the Kansas City ARTCC area.

The ARTCC forecasters are equipped with a radar scope that can display thunderstorms, the ARTCC route structure, aircraft, and the projected routes of aircraft on IFR flight plans. Such information combined with data from several weather radars and wide-area PMSV opens a new dimension in enroute weather watch. The meteorologist now can see both the weather and the aircraft on radar; he can also get in-flight pilot evaluation of the weather. The result is a more complete, responsible capability to help aircrews avoid weather hazards.

The test service is available at Kansas City now. When you're operating in the Kansas City ARTCC's area of responsibility, use it. To assist in evaluating the test's utility, your comments should be given to the AWS weatherman at your destination. ★

THE FALCONER

TSgt ALFRED C. SWIFT
513 TAW



While US Air Force Security Policemen watch the entrance to RAF Mildenhall, England, with eagle eyes, a different type of policemen watch the skies.

These policemen are Lanner Falcons and are handled by "The Falconer," Mr. Phil Bland. They have none of the sophisticated weaponry of modern jet fighters—just feathers, talons and all the natural instincts of birds of prey.

Phil is a former hotel owner from Northamptonshire, England. The Falconer and his ten falcons work from dawn to dusk, seven days a week, scanning the skies over the 1,000 acres of land that make up the American transport base. They look for flocks of lapwings, seagulls, pigeons or any other flock of birds that could damage expensive jet engines if they were ingested into them and possibly cause the aircraft to crash.

RAF Mildenhall is known as the "Gateway to the United Kingdom." Nearly all US military personnel and their families who come to England for an assignment, process through the base's passenger terminal.

Charter flights come into the base about 15 times per month, carrying troops and their families, while military aircraft bring in additional people. About 8,000 people pass through the Gateway every month.

Huge C-5 Galaxies, C-141 Starlifters, C-130 Hercules and KC-135 Stratotankers make up the bulk of the military aircraft passing through Mildenhall.

Naturally with this large number of people and expensive aircraft, the US Air Force needs to protect them as best it can.

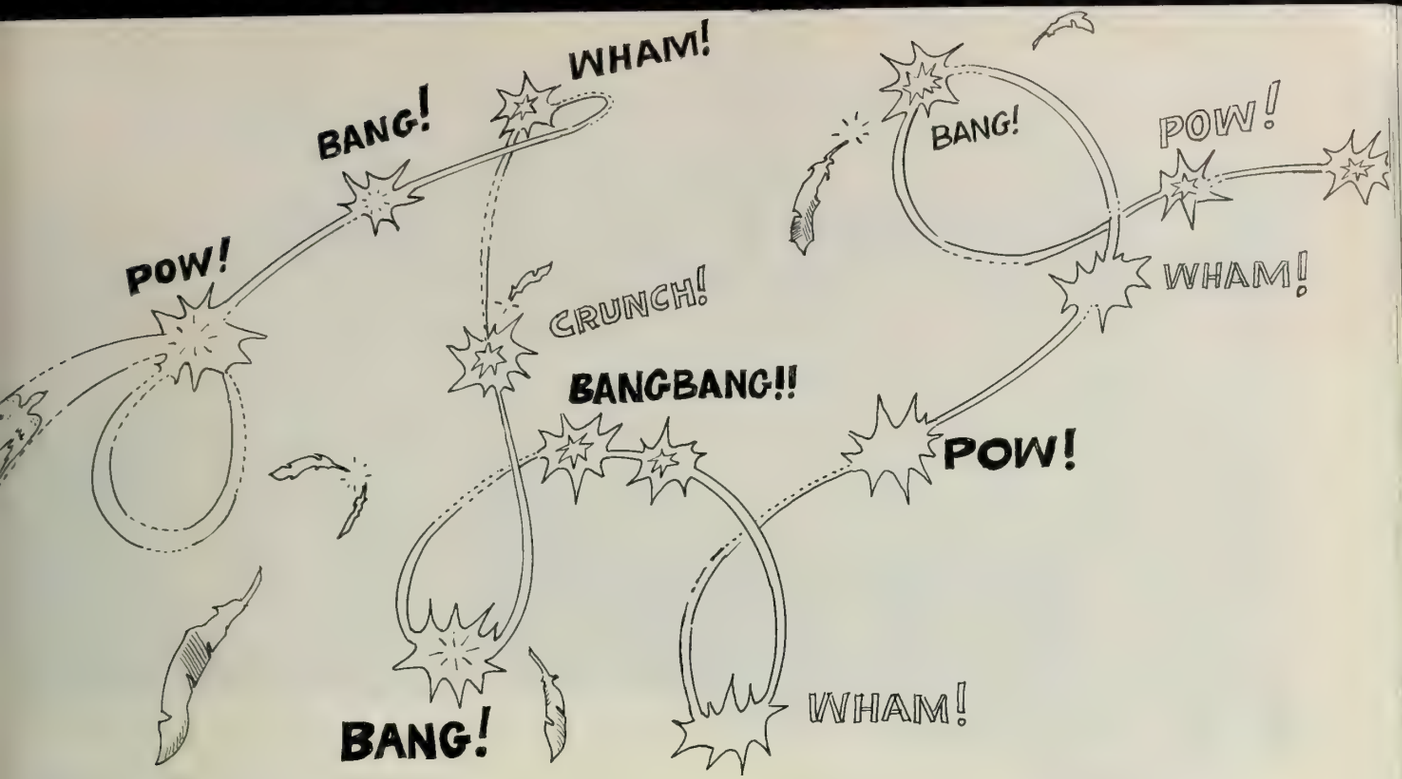
England's Royal Air Force (RAF) uses a taped recording of bird calls to scare off unwanted birds. But in spite of this, they continue to lose aircraft. Three Harrier Vertical Takeoff jet fighters were lost in 1971 due to bird strikes. A civilian Falcon fanjet crashed at nearby Norwich airport while taking off two years ago—it flew into a flock of seagulls. No injuries resulted from that one but the airplane was a complete write-off.

"Operation Longwing" started in England in 1970 after recordings, shotguns and many other methods of removing birds from the airfields had failed. The Falconer summed it up by saying: "The birds got used to the 'all talk and no action' concept of the recording devices, and the shotguns only spooked them for a few seconds, then they would settle back down on the field again.

"During the first two years of Operation Longwing, the RAF had 343 recorded bird strikes and the USAF had 11. This covered the six major US bases in the United Kingdom (RAFs Mildenhall, Lakenheath, Bentwaters, Woodbridge, Alconbury and Upper Heyford.) Of the 11 strikes, only five caused any damage and no major damage was noted."

Major General John A. Bell, Third Air Force Commander in 1970, conceived "Operation Longwing" after watching a display of Falconry. He initiated a study of using falcons on US Air Force bases, found it to be successful and placed it into effect.

Headquarters United States Air Forces in Europe (USAFE) made a



recent study on the value of falconry, looking at the cost of the operation as opposed to the amount of money and lives saved.

As a result of the Survey, "Operation Longwing" in England is now considered mission essential.

According to the Falconer, the Royal Navy first introduced the use of falcons for bird control around an airfield at Lossiemouth, Scotland, just after World War II. "Aircraft would be deployed a squadron at a time," Phil said, "and the Falconer would only fly his birds just prior to a launch or immediately prior to the squadron's returning to the base."

Phil Bland is a former Royal Navy man himself. He was Chief Petty Officer Air Gunner during WW II, and put in 12 years service with the Fleet Air Arm.

"When we were flying during the war," he explains, "we would often run into a flock of birds. They didn't do as much damage to us as they do to modern day aircraft because we were flying the old propeller driven, piston engine aircraft. They were a lot slower than today's planes, and the propeller blades would just chew the birds up and throw them behind us."

Phil was introduced to Falconry as a boy; now, it's a very busy full time job and he says he wouldn't trade it with anybody. If afforded the opportunity, he would love to prove to commercial airports, either in the United States or Europe, that lives and aircraft could be saved by using falcons for effective bird control.

Most of the Falconer's birds of prey are purchased from Africa as young birds. Then, he trains them, not tames them, otherwise they would lose their natural instinct to kill. Without that natural instinct driving them on, they would not go up and drive other birds away from the area.

Phil explained that East Anglia, in which Mildenhall is located, is not just a rural farming area, but one of the busiest migratory routes for birds in this country. Because of the many nature reserves in that part of England, some birds are attracted to the airfields because they like nesting by large open spaces.

Phil rarely allows his falcons to kill other birds, otherwise they would get used to it and would no longer depend on him for their livelihood. They are fed daily on fresh meat purchased locally.

The Falconer works closely with Air Traffic Controllers and is in either telephone or radio contact with them all the time he's on duty. If the control operator spots a flock of birds, he calls Phil, who takes a falcon out to have a look around.

Other times Phil can be found in one of his two Land-Rovers patrolling the base, looking for birds. On a busy day he may fly each falcon on three or more flights chasing birds away.

All the US Air Force bases in England use "Operation Longwing," but Mildenhall's Phil Bland has the distinction of having done his job professionally longer than anyone else in the world.

"I get a lot of satisfaction from my job," Phil said, "if I and my falcons can prevent a multimillion dollar aircraft like the C-5 Galaxy or a DC-8 with a couple of hundred people on board from crashing, then I have more than earned the money I'm paid.

"My method of operation at the airfield is simple," Phil Bland emphasized, "it's pitting nature against nature, for the protection of resources and people, and it works." ★

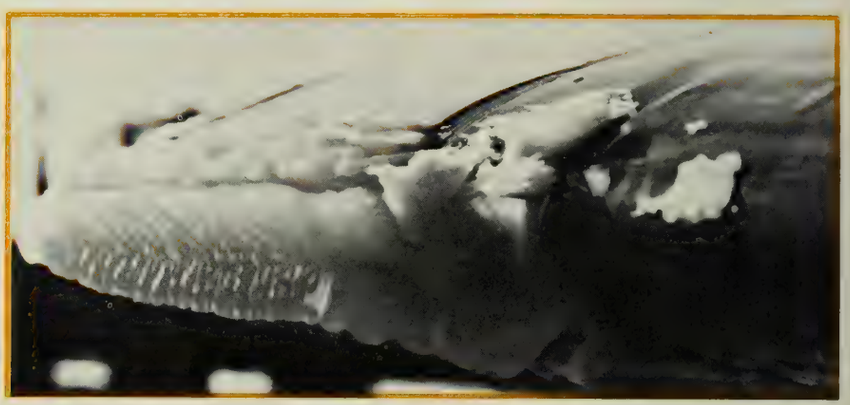
ice and airfoils

Courtesy January 1976 Northrop F-5 Technical Digest



Prevention, not removal, is the name of the game for ice on jet engine intakes in flight.

Ice buildup on leading edge of an airfoil. Weight of the ice and its affect on wing configuration can be dangerous.



The penetration began at 20,000 feet. There were three layers of clouds between 20,000 feet and 1500 feet that the F-5A had to pass through. The lower layer was nearly 3000 feet thick with icing conditions prevailing. The F-5A was flown on initial approach at 170 KIAS with air-speed reduced to 155 coming over the fence. The flare was started at 145 KIAS and the aircraft stalled and made a hard contact with the runway at 140 KIAS. The calculated touchdown speed should have been around 133 KIAS.

The F-5A touched down on the right main landing gear, bounced and was quickly brought under control by the pilot. Upon deplaning the pilot and ground crew noted that the leading edge of the wing and air inlet ducts had a layer of rime ice ⅜ of an inch thick, and the leading edge of the vertical and horizontal tail were covered to approximately ½ inch. The ice had also coated an area of about 4 inches of the underside of the wing from the leading edge aft.

Without becoming academic and just to refresh your memory on ice producing conditions, let's review some basic fundamentals that apply in the foregoing near accident/incident.

Ice forms when two conditions prevail. Moisture in liquid form must be present in the air and the effective temperature must be freezing or lower. All clouds contain moisture in one form or another so icing can be expected if the temperature is at or below freezing. In fact, light ice or frost forms when an aircraft flies from a cold area that has reduced the temperature of the airplane itself to freezing, into a saturated cloud where the temperature is above freezing.

Supercooled water droplets can exist in the atmosphere as a liquid at temperatures as low as −40 C. These droplets do not freeze because of the surface tension of the drop, its salt content, and most important, the liquid is undisturbed. Once it is disturbed or broken, as when it is struck by the aircraft, the drop quickly transforms into ice.

Rime ice is formed by the instantaneous freezing of small supercooled water droplets upon contact with the aircraft surfaces. Fast freezing can take place when the temperature is anywhere from 0°C to



Ice on this helicopter was deposited during test. In flight such a condition as shown could be catastrophic.

−40°C. Since the individual droplets freeze in individual spheres on the airfoil and the freezing is instantaneous, a large amount of air is trapped within the ice. This gives the ice an opaque appearance, makes it very brittle and relatively easy to break off. Rime ice does not normally spread over an aircraft surface, but protrudes forward into the airstream along the leading edges of the aircraft's airframe. The weight of rime ice per unit is less than clear ice. However, the danger lies in the added drag created by the disfiguration of the airfoil. Incidentally, most structural ice has a pronounced effect on the aerodynamics of the airfoil. In its purest form, rime ice is found generally in stable cloud conditions where vertical or turbulent air currents are restricted. Such conditions are typical of a stratus-type cloud layer.

Clear ice is formed by the relatively slow freezing of large supercooled liquid-water droplets, which have a tendency to spread out and assume the shape of the surface on which they freeze. As a result of the spreading of this supercooled water and its slow freezing, very few air bubbles are trapped within the ice, which accounts for its clearness. Clear ice is tenacious, harder, smoother, and more difficult to deice or remove once it has built up. At times it may appear rough, but it is never granular like rime ice. You should keep in mind that clear ice also forms rapidly on aircraft while flying in zones of freezing rain or drizzle. Clear ice is most likely to form at temperatures from 0°C to about −10°C. However, it may occur with temperatures as low as −25°C and at altitudes as high as 40,000 feet in cumuliform clouds.

Lengthy studies pertaining to the icing characteristics of clouds show that in stratus (layer type) cloud formations, the actual icing region is seldom more than 3000 feet in depth with 1000 feet the more usual occurence. However, the icing region can extend for many miles horizontally. For cumulus-type cloud formations, the depth of icing is considerably greater but the horizontal dimension of the icing area is seldom greater than three miles; therefore, whenever operational conditions permit, the general rule should be to change altitude (climb or descend) when encountering layer cloud (stratus) icing, and vary course as appropriate in order to avoid cumulus type cloud icing.

Aircraft icing is one of the major weather hazards to aviation. It affects an aircraft both externally and internally. The pilot should anticipate and plan for some type of icing on every flight conducted in clouds with temperatures colder than freezing. He should be familiar with the icing generally associated with different atmosphere conditions. You should keep in mind that a weather forecaster cannot generally observe icing. They rely on pilot reports. They can only forecast the probable maximum intensity of icing that may be encountered during a flight, but not necessarily the intensity of icing that will be encountered by a particular aircraft. Many variables bear upon icing problems. It is the pilot's responsibility to make certain he obtains a complete weather briefing to include the information he deems necessary to the safe completion of his proposed flight, not only to minimize any icing hazard, but all hazards of flight. ★

FOR CREWS Ground and Air

One score and 12 years ago our forefathers in the Army Air Force brought forth a document dedicated to the idea that aircrews' lives are precious and the loss of critically needed aircraft excessive. That document titled *Flying Safety* has endured and its pages have chronicled the achievements of men in their constant quest for flying safety. Today we call it *Aerospace Safety*.

As we look back we see 20,000 aircraft accidents a year reduced to 118; our people living instead of dying—5603 dead in 1943, not in combat—in accidents—with the toll reduced to 98 in 1974.

We rejoice for those crewmen and our aircraft that have survived the demands of the relentless sky. But our gladness is muted when we consider the ruthless advance of the cost monster. Whereas an average aircraft accident cost $940,000 in 1964, today the Air Force worth is reduced by the amount of $2,200,000 per-accident. In one year we are seeing the loss of $312 million.

Let us dedicate ourselves then to the idea that not only are aircraft accidents preventable, they are also intolerable. With this thought uppermost, we have set the course of this publication toward the Air Force air crew. And in our crusade to extinguish the maintenance-caused accident we have created a new vehicle known as *Maintenance*.

Whereas, this magazine is hereby dedicated to aircrews everywhere and,

Whereas, a sister magazine is to be devoted to our maintenance people,

Therefore, effective this date, *Aerospace Safety* will address the needs, problems and interests of aircrews and those who provide them close support.

Further, the journal for the maintenance people, those unsung heroes who labor long so that their machines will safely fly, will be known as *Maintenance*.

May both of these succeed in their missions so that they may earn the respect, affection and support of those they are dedicated to serve.

In other words, guys, these two mags are for you. And the pages are open. Let's hear your advice, comments, gripes, but most of all your ideas and knowledge that can be passed on to others in your professions. Thanks—your editorial staffs. ★

☆U.S. GOVERNMENT PRINTING OFFICE 1976 789/855/30

ED STATES AIR FORCE

Well Done Award

Presented for

outstanding airmanship

and professional

performance during

a hazardous situation

and for a

significant contribution

to the

United States Air Force

Accident Prevention

Program.



First Lieutenant
KENNETH C. ARMSTRONG
85th Flying Training Squadron
Laughlin AFB, Texas

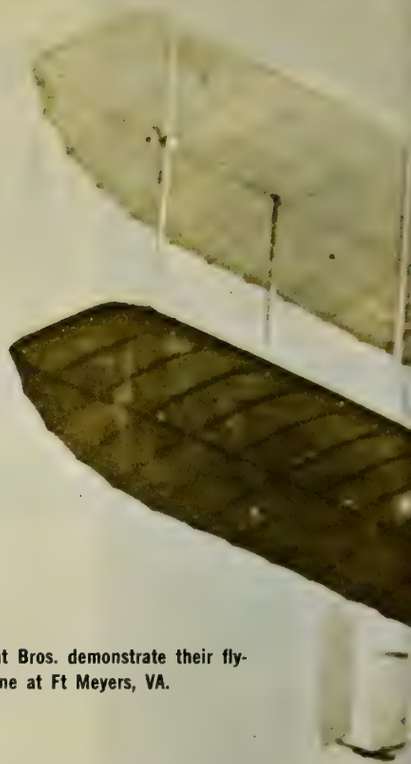
On 23 January 1975, Lieutenant Armstrong, the IP, and his student launched on an instrument mission in a T-37. Weather was 400 scattered, measured 700 overcast, 3 miles visibility, fog, wet runway, and cloud tops 13,000 MSL. On takeoff leg in the weather with the student flying the aircraft, Lieutenant Armstrong observed that the attitude indicator showed 8 degrees nose high, but the vertical velocity was less than 1,000 feet per minute. He took control and made a slight nose-up pitch change, at which time the attitude indicator rolled to indicate a vertical climb and began counterclockwise controlled precession at the near vertical position. Lieutenant Armstrong attempted to use the right turn-and-slip indicator to keep the wings level, observing the needle to be centered but all three heading indicators showing the aircraft in a turn. Realizing that from his vision angle the left turn needle would be of little value, Lieutenant Armstrong began to make small aileron control inputs until the heading indicators stabilized. With the wings level, he then made small pitch corrections to maintain a straight climb at 200 KIAS.

At approximately 6700 MSL, Lieutenant Armstrong found a clear space 100 feet high between the cloud layers. Knowing that the cloud tops were 13,000 MSL, he elected to remain in the limited VMC conditions he had encountered rather than climb an additional 6300 feet in the weather. After leveling off in the clear space, Lieutenant Armstrong determined that AC power was available and that the attitude gyro fuses were not burned out. The supervisor of flying assigned a chase aircraft which assumed the lead and the flight executed a formation PAR recovery.

Lieutenant Armstrong's timely assessment of a critical situation and his professional ability prevented possible injury to the crew and the loss of a valuable aircraft. WELL DONE! ★

FROM WHENCE WE CAME

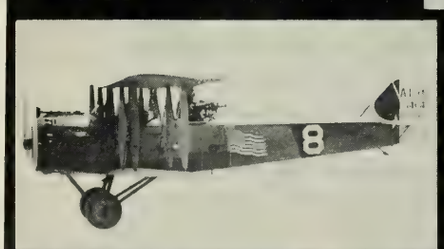




The Wright Bros. demonstrate their flying machine at Ft Meyers, VA.

This Bicentennial Year is a time to look back From Whence We Came. In that interest we believe that our proud US Air Force heritage holds much to offer. From very crude beginnings we have sped to the very edges of space and have fought in four wars along the way. In this and future issues we hope, with your help, to pay homage to the valiant and farseeing few who made it happen. For more, turn to page 14.

L to R. The Salmson 2-A, flown by the A.E.F. in WW I; The Boeing P-12, one of the finest bi-wing pursuits ever; the legendary 8th AF's B-17 over Germany in WW II; the F-80 using JATO assist flies over F-86 in Korean War days; the F-4 Phantom gets ready in Vietnam; SR-71 pilot's flying garb.









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SAFETY MARCH 1976

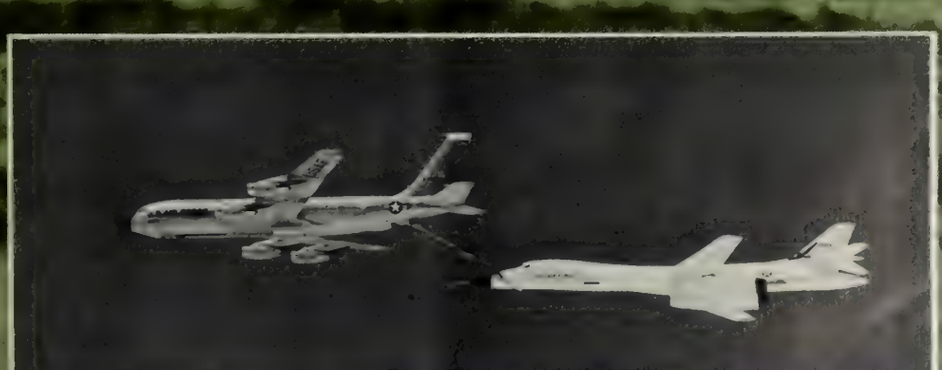


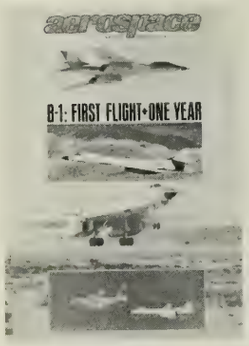
B-1: FIRST FLIGHT+ONE YEAR





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UNITED STATES AIR FORCE MARCH 1976

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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MARCH 1976 AFRP 127-2 VOLUME 32 NUMBER 3

OPS TOPICS

A TIP OF THE HAT

Congratulations and a Well Done are in order for the commander and members of Air Training Command. Despite a challenging mission with some fairly high accident potential, they have achieved a truly enviable safety record. In particular, the record for 1975 is outstanding. Super job, guys, keep it up!

ATC MAJOR AIRCRAFT FLIGHT ACCIDENTS

YEAR	RATE	TOTAL*	T-37	T-38
1970	1.7	22	5	16
1971	0.8	10	2	5
1972	1.3	14	4	9
1973	1.0	10	3	7
1974	1.1	9	1	8
1975	.429	3	1	1

*The totals include other aircraft beside the T-37/T-38. T-41/T-39, etc.

GOOD JUDGMENT

A MAC C-130 pilot made a wise choice when, rather than trust a follow-me truck, he stopped to verify his wing tip clearance. The wing overlap with another C-130 was approximately 15 feet! Taxi accidents are always hard to explain. When in doubt, stop and check the clearance.

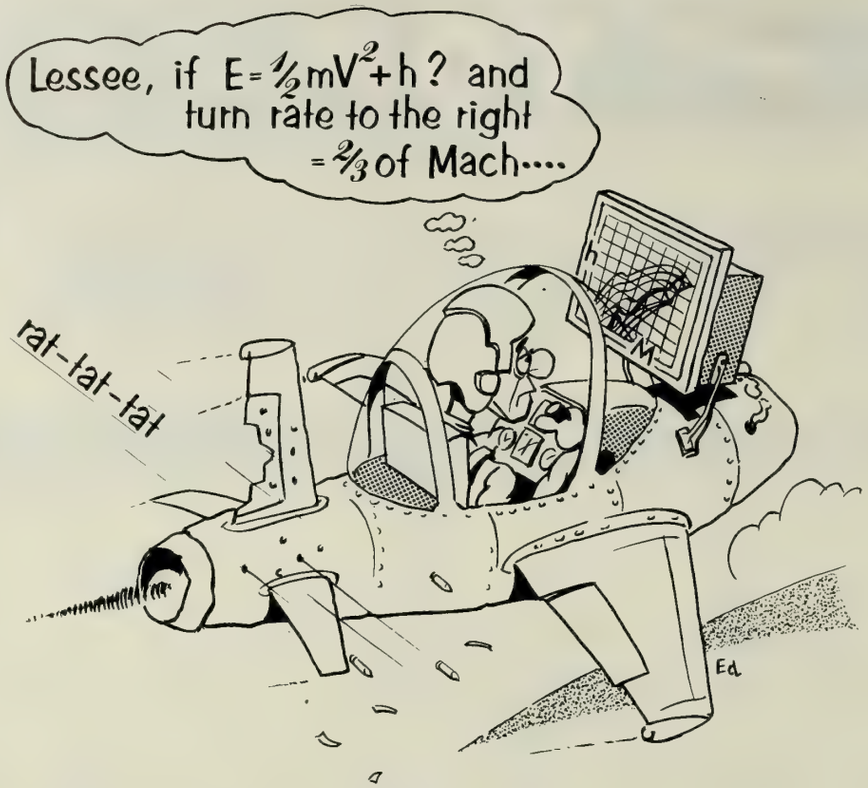
CONFLICT ALERT

FAA has completed nationwide installation of its conflict alert system which flashes a warning signal on radar displays to alert air route traffic controllers when aircraft are projected to be in possible conflict with one another. All 20 ARTCCs in the continental U.S. now have completed the initial step of the program which was to implement conflict alert in the high altitude sectors above 18,000 feet. In addition, the system was to have been operational above 12,500 feet by early February. The conflict alert system is a computer program that has been added to the central computers at the 20 centers which provide IFR service. It projects what the flight paths of aircraft will be in the next two minutes and alerts the controller when there is a possibility of a conflict between aircraft.

LOCKED BRAKE

Three F-4's had completed a local mission and were recovering by VFR overhead patterns. As nr 2 rolled out on final, he encountered mild jet wash from lead. He was able to control the aircraft without difficulty using ailerons and rudder. The aircraft touched down normally but after about 250 feet of roll, the left tire blew. It seems that, because of his size, the pilot has difficulty using rudders without applying pressure to the brakes. One of the recommendations of the investigator is for pilots to develop a habit of consciously checking foot position on the rudders before landing.

More on Page Six



When the choice is max corner velocity or take it home, would an energy maneuverability display put you on the . . .

SAFETY RAZOR'S EDGE?

MAJOR ROBERT P. (BAT) BATEMAN
Air Force Flight Dynamics Laboratory
Wright-Patterson AFB, OH

In the old days, when a pilot judged his airspeed by the sound of the wind in the wires, his altitude by the size of rooftops and his turns by needle and ball, he carried with him an internal stall sensing device known as "seat of the pants." The best turn rate was achieved by honking on the stick until the familiar burble warned him of an impending stall, But that was in "the old days. . . ."

Today's burble can mean anything from, "Your flaps are down," to "Your stick shaker is malfunctioning." The old reliable cues are gone forever. What is worse, the rules of thumb don't work anymore either. The best turn rate (corner velocity for you fighter jocks) refuses to stay at 300 KIAS, or any other speed. Today, we can go faster, higher and farther than the wildest dreams of the barnstormers, but our expanded performance envelope has only served to conceal the points of optimum performance.

We will have to find new performance criteria to measure excellence. It may not be a whole new ball game, but in air combat, the factor determining the winner is going to change. The adage, "Airspeed, altitude or GO HOME," will lose its validity when we enter the age of optimization:

Optimum
Sustained Maneuvering,
Acceleration,
Climb,
Turn.

We are not there now. Not quite. Even the very best of pilots cannot consistently find the razor edge that defines the best of all possible maneuvers: *perfection*. But Jonathan Livingston Seagull lives in all of us, and we try. And just like Jonathan, we sometimes fail. But unlike that marvelous bird, we end up with more than rumpled feathers. Accidents happen because pilots, trying for that extra centimeter of performance, get into trouble before they know what is happening.

It would help if we had feedback, information on how we are doing, benchmarks of performance. Engineers know that corners exist where turn rate is optimized. Col John Boyd demonstrated the energy-maneuverability relation over ten years ago, but this vital information is still not displayed in our cockpits. A look at the cartoon to the left will explain one reason why: When the call is "Rover Flight, bogies at 5 o'clock, break right!," no jock in his right mind is going to try to interpret that maze. The second reason why a useful *energy-maneuverability display* (EMD) is not already in-

The Flight Dynamics Laboratory at Wright-Patterson is taking a look at various ideas on energy maneuverability displays to help you get the most out of your craft. Three of the possible visual arrangements are depicted here. What do you think? Here's your chance to get your ideas cranked into the design.

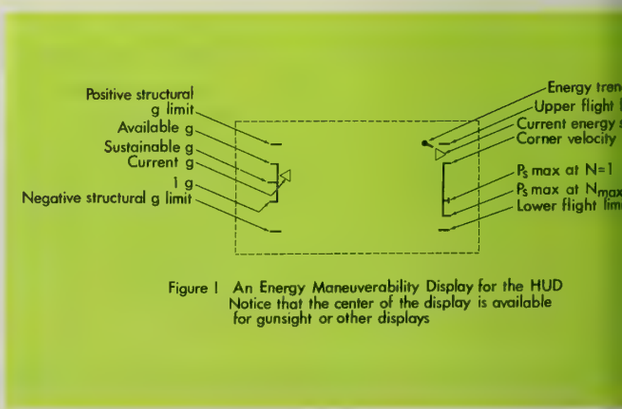


Figure 1 An Energy Maneuverability Display for the HUD Notice that the center of the display is available for gunsight or other displays

stalled and functioning is that the parameters cannot be measured directly. Unlike altitude, angle-of-attack and heading (and all those other familiar goodies), optimum maneuver points must be computed, and until now, there has been no way to continuously solve the problem in real time.

And so, we brief estimated corner velocities at standard temperatures, average altitudes and most probable weights, and the jock with the best guess wins the hassle. Sort of like a football pool—which is kind of fun—unless you happen to be betting your life (or whatever) on the results. At this time, the prudent jock decides, golden hands or not, it's "Airspeed, altitude or GO HOME." — and that doesn't win wars.

Until now. (Blow the bugles, wave the flag, and strike up the band with a few bars of "The Stars and Stripes Forever." Those engineers have finally done us a favor. As a result of contracts negotiated by your Air Force Flight Dynamics Laboratory (end of commercial), simplified displays are being developed. On-board digital computers are available which can reduce complicated energy-maneuverability diagrams to a couple of one-dimensional displays that provide us with the option to choose the desired maneuver. The same computers will display the information we need to achieve the optimum performance we have selected.

Plainly speaking, it is possible to develop a display to give a pilot information on optimum maneuvering. The question is, "How do we display this information?" Of course, every engineer in the world has an answer, and every psychologist has an opinion. That's O.K., because having answers and opinions are their jobs. But flying airplanes is your job, and so I'll repeat the question: "How do we display energy-maneuverability information?"

Several attractive solutions have been offered. One possibility involves displaying energy state as a kind of altitude, and indicating whether a pilot needs to go up or down to achieve a desired performance. This is matched with a vertical G meter that indicates sustainable and available G's, as well as aircraft structural limits. These two vertical scales can be displayed on the HUD for easy reference (see Fig. 1). The left side (G's) shows what performance you can get now. The right side ("energy altitude") shows where you can go to do better.

On the right side, the energy trend indicator shows whether you are losing or gaining energy (or holding your own); Col Boyd's "maximum maneuver region" is shown on the right-hand side between P_S max at 1 G and P_S max at maximum G. P_S max at 1 G also serves as a benchmark for the Rutowski climb path and provides guidance for nearly optimum accelerations. The corner velocity is also displayed, along with upper and lower flight limits.

On the left side, the sustainable G limit, where P_S equals O, is shown. Upper and lower structural limits are also indicated, and when maximum attainable G is less than the structural limit, it, too, is displayed.

Referring to Figure 1, the left side of the display shows the pilot that:

1. He is pulling more G's than he can sustain, but
2. Less than available,
3. Since available G's are below structural limits, the pilot can reason that his velocity must be below the corner velocity.

The right side also tells him that:

1. He is losing energy, and
2. That he is above the altitude for corner velocity.

Corrective action to achieve the maximum turn rate (or corner velocity), assuming that throttle is already at maximum setting, and assuming that the pilot can take the action without being shot down is to:

1. Unload and
2. Descend

A key advantage of this display is that it leaves the center space available for any kind of gunsight or missile launch display that is desired. LCOS, HOTLINE and SNAPSHOOT displays are all compatible with this HUD display. It is possible to present this same information on a helmet mounted display when suitable hardware is developed. Still unanswered are the key questions, "Will it provide fight-

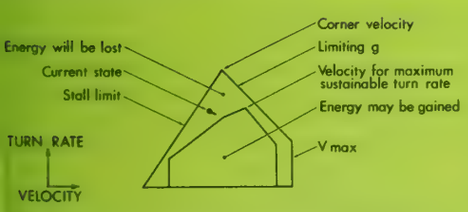


Figure 2 Two-dimensional Energy Maneuverability Display

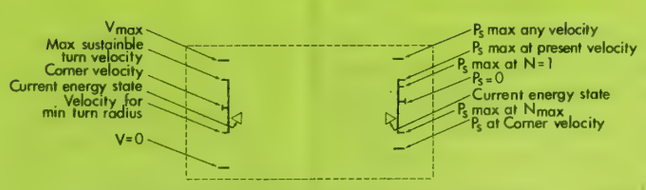


Figure 3 A third Energy Maneuverability Display

er pilots with the information they need to maintain a tactical edge over aircraft with similar characteristics?" and "Is the information presented in the best format?"

A possible difficulty may exist because a pilot must interpret energy as altitude and deduce airspeed conditions. There is a way to display key performance conditions in terms of airspeed, leaving the pilot to adjust his altitude to attain required velocities. By plotting turn rate against velocity, a nearly linear two-dimensional display results. (See Fig. 2)

The upper lines show available turn rates over a complete range of velocities. It should be noted that they do change with altitude changes. The inner polygon shows turn rate performance that can be sustained. Operation within this area allows energy to be gained; operation outside the smaller polygon results in energy loss.

Information presented in Figure 3 tells a pilot that:

1. He is turning at a faster rate than he can sustain, but
2. He can turn at a faster rate, if he is willing to accept an even greater rate of energy loss
3. Velocity is below corner velocity
4. He is losing energy
5. He is slower than corner velocity.

Corrective action to achieve the maximum turn rate, assuming that the throttle is already at maximum setting, and assuming that the pilot can take the action without being shot down is to unload. The decision to descend to attain corner velocity is not prompted by the display, but this course of action is still available to the pilot.

Actually, the same situation is presented in both Figures 1 and 2. For the display in Figure 1, airspeed must be interpreted, for Figure 2 altitude must be interpreted. There is no easy answer to this dilemma since energy exists as a combination of altitude and airspeed. The two-dimensional display may be more difficult to read than the two one-dimensional bars in Figure 1, and it lacks room for gunsight data.

Choosing a "best" EMD is further complicated by other options. The first involves reducing Figure 2 to a group of points that represent the corners of the polygons. This reduces some of the clutter without really altering the computations or information content. A second possibility is to collapse the polygons of Figure 2 onto the horizontal (velocity) axis, and then display the velocity scale vertically on the left of a display as in Figure 3. The right side is programmed to be "G" or turn rate dependent, showing on the internal scale how to manage stick forces to get energy changes at the present velocity. (Notice that P_S max at 1G, a Rutowski climb path benchmark is available, along with sustainable maneuver data [$P_S = O$].) The outer limit markers show maximum energy loss at the bottom and maximum energy gain at the top.

This display relates performance to velocity, rather than altitude and keeps the center open for gunsight data. It provides climbing as well as turning parameters. The right side shows performance available at the present velocity, the left side shows how velocity can provide improvements on these parameters. Unlike the first two displays. it has not been developed or mechanized since it is only a proposal.

Each of these displays claims the potential to give you, the pilot, the information you need in a format you can understand and use to improve your performance. What do you think?

If your interest in energy-maneuverability is great enough to devote a little more time, the following questionnaire is designed to help psychologists and engineers interpret your ideas. From all the information at hand, it appears that the F-16 is going to have an energy-maneuverability display. It is only a matter of time before one of these displays begins to share a cockpit with you. The feedback on your energy-maneuver state will allow you to elicit the absolute optimum performance from your aircraft, if you can understand it. If none of these formats meet with your approval, send us a sketch of your own ideas.

Mail sketches, questionnaires, and comments to:

AFFDL/FGR
ATTN: Maj Bat Bateman
WPAFB, OH 45433

ABOUT THE AUTHOR

Major Robert P. (Bat) Bateman completed flying training at Webb AFB, Texas, and served there as an instructor. Later he was assigned to the 8th Tactical Bomb Squadron at Clark AB and completed 225 combat missions in the B-57, many of them at night under flares. After short stints in the F-100 and F-4D, he was assigned to Nellis AFB, Nevada as an F-111 pilot.

He is a distinguished graduate of SOS and has a Masters Degree in Astronautical Engineering from AFIT. After a return trip to SEA, where he served as Battle Staff Operations Officer in the airborne command post, he was assigned to the Air Force Flight Dynamics Laboratory, Crew Systems Integration Branch. He heads the Digital Applications Group and manages Energy - Maneuverability Display Development.

He has been awarded the Silver Star, the Distinguished Flying Cross with 3 oak leef clusters, the Meritorious Service Medal, the Air Medal with 13 oak leaf clusters, and the Air Force Commendation Medal. ★

QUESTIONNAIRE:

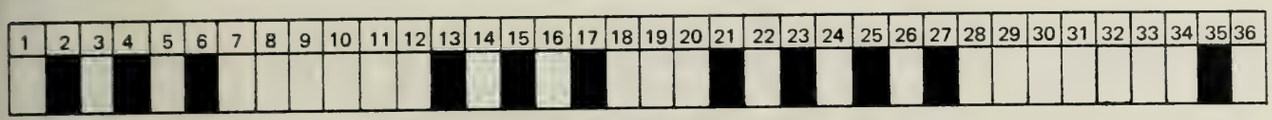
WE NEED YOUR EXPERT OPINION!

On a reproduction copy of this page or a separate sheet of paper (in order to save this magazine for the next reader), please complete this questionnaire. Rush your answers to:

AFFDL/FGR
ATTN: Maj Bat Bateman
WPAFB, OH 45433

Thanks for the effort; your answers will be used.

After selecting your answers, enter the appropriate number in the corresponding block.



BLOCK 1 - *YOUR STATUS*

Non Rated	(0)
Rated Pilot	(1)
Navigator	(2)
Other	(3)

BLOCK 3 - *FLYING TIME*

0	(0)
1 to 1500 hours	(1)
1501 to 3000 hours	(2)
3001 and over	(3)

BLOCK 5 - *YEARS RATED*

0	(0)
1 to 3 years	(1)
4 to 8 years	(2)
9 years and over	(3)

BLOCKS 7 - 12 - *RATED EXPERIENCE*

Enter in Blocks 7 - 12 the codes for the planes (up to 3) you have flown most (at least 100 hours)

01	F-4	11	A-7	21	F-106	31	T-38	41	B-52	51	C-5
02	F-15	12	A-10	22	F-102	32	T-33	42	B-58	52	C-135
03	F-16	13	A-1	23	F-101	33	T-37	43	B-47	53	C-141
04	F-105	14	B-57	24	F-104	34	T-28	44	B-66	54	C-130
05	F-100	15	F-111	25	F-89	35	T-41	45	FB-111	55	C-123
09	Other Similar	19	Other Similar	29	Other Interceptor	39	Other Pilot Trainer	49	Other Bomber	59	Other "C"
61	KC-135	71	RF-4	81	OV-10	91	HH-34				
69	Other KC	72	RF-101	82	O-1	92	HH-53				
		73	RB-57	83	02	93	CH-3				
		74	U-2	89	Other FAC	94	HH-43				
		79	Other Recce			99	Other Choppers				

Category not listed above, enter 00
(Seaplanes, Utility, Weather Recce, Experimental, Etc.)
(Naval or Marine Aviators attempt to classify type before selecting 00)

BLOCK 14 - *YOUR RANK*

Enlisted	(0)
0-1 to 0-3	(1)
0-4 to 0-5	(2)
0-6+	(3)
Other	(4)

BLOCK 16 - *ENERGY-MANEUVERABILITY INFORMATION IS:*

Worthless	(0)
Possibly of use to someone else but not me	(1)
Possibly useful to me	(2)
Definitely useful to me	(3)

BLOCKS 18 - 20 - *LIST IN ORDER OF IMPORTANCE THE THREE MOST VITAL ITEMS OF INFORMATION FOR MAXIMUM PERFORMANCE MANEUVERING*

Corner Velocity	(1)
Maximum Sustained Turn Velocity	(2)
Ps (Energy Rate)	(3)
G Load	(4)
Rutowski Climb Path	(5)
Best Acceleration Velocity	(6)
A/S	(7)
Altitude	(8)
Alpha	(9)
Something Else	(0)

BLOCK 22 - *THE ENERGY - MANEUVERABILITY DISPLAY*

Is Not Needed	(0)
Should Be On Instrument Panel	(1)
Should Be On HUD	(2)
Should Be On Helmet Visor	(3)

BLOCK 24 - *OF THE DISPLAYS DISCUSSED, I LIKED:*

None	(0)
Any One, No Opinion	(1)
Fig. 2, Altitude Energy Display	(2)
Fig. 3, Two-Dimensional Display	(3)
Fig. 4, Airspeed Energy Display	(4)

BLOCK 26 - *IN MY OPINION, AN ENERGY-MANEUVERABILITY DISPLAY COULD BE USED FOR:*

Nothing	(0)
Training Only	(1)
Combat and Training	(2)
Other Mission	(3)

BLOCKS 28 - 34 - *INFORMATION FROM AN EMD COULD GIVE A PILOT AN ADVANTAGE IN:*

	No	Yes
Turning	0	1
Climbing	0	1
Accelerating	0	1
Learning Performance Limitations	0	1
Extending Range	0	1
Defeating Hostile Aircraft	0	1
Saving Fuel	0	1

BLOCK 36 - *AIMING/SIGHTING INFORMATION SHOULD BE PRESENTED:*

On The HUD	(0)
On A Helmet Visor	(1)
On A CRT Or Radar Scope	(2)
All Of The Above	(3)

OPS TOPICS

HOT START

The KC-135 crew had responded to an alert. When they attempted to start engine nr 4 the cartridge fired but after the throttle was brought to idle, the crew chief reported no ignition noise. The rpm built to about 25 percent and then began to decay. Then the crew chief discovered a fire in nr 4. The crew and the crew chief extinguished the fire with a portable fire bottle. The fire occurred because an intermittent circuit breaker failed to provide ignition with the throttle in idle. This allowed fuel to pool in the engine and to be ignited by the hot gases from the starter cartridge.

SLUSH + COLD = GEAR UP LANDING

An EB-57 took off after taxiing through slush on the taxiways. The gear was cycled at five and again at 10 minutes after takeoff to insure proper operation. However, when the pilot tried to lower the gear for landing 1 + 50 after takeoff, the nose gear would not come down because it was frozen in the well by an accumulation of ice. The ice formed from slush splashed into the well during taxi. Since the aircraft had insufficient fuel to divert to a warmer alternate, the crew made a gear up landing.

LOOK AGAIN

When the T-39 took off from an intermediate stop, the right overwing fuel filler cap departed. The cap had not been opened during refueling since single-point was used. The aircrew checked the caps visually on preflight. The AO discovered the cap undamaged beside the runway about two hours after the T-39 took off.

IT CAN HAPPEN

The T-39 was cruising at FL 290 when the crew heard a boom. The cabin pressure fail light came on, and the cockpit and cabin filled with fog. The cabin altitude went from 7500 feet to 25,000 feet in about 10 sec. Fortunately the crew was well trained and prepared for such an emergency. They had briefed the passengers properly so there were no injuries or difficulties. How long since you reviewed your emergency procedures for loss of pressurization?

IT'S THE LITTLE THINGS THAT COUNT

The student pilot was attempting to fly a circling approach at a strange field. The IP demonstrated the proper downwind position and gave control of the T-38 to the student. During the turn to final, the student mistook an asphalt taxiway for the landing runway. The IP, concerned with altitude, airspeed and glide path, neglected to identify the error in alignment until just prior to touchdown. He recognized the mistake when he realized that aircraft are not usually parked along active runways. Neither the IP or the student used any of the visual clues available for alignment such as runway markings, VASI lights and aircraft/runway heading comparisons. The visibility was 40 miles on this day. Suppose it had only been two miles!

OPS TOPICS

OLD LESSON RELEARNED

Every now and then an old lesson comes back again, sometimes the hard way in the form of an accident. Here's an incident in which the pilot was lucky. The flight of fighters was landing on runway 15 with winds at 270, 17 gusting to 21 kts. Tailwind component was 10 kts and crosswind component 19 kts. Other aircraft had reported considerable turbulence on short final. With the wind in mind, the pilot flew an excessively fast final and touched down long and fast. Aerodynamic braking was not tried, because of the crosswind. The drag chute was immediately deployed but the risers broke and the canopy streamered. Brakes just weren't going to do the job, so the pilot lowered the hook and the BAK-9 worked as designed. Good! Nobody got hurt. But it cost the Air Force $5,000 to replace the tires, brakes, and antiskid. The lessons are obvious here. But do we have to keep relearning?

LAST CHANCE WORKS

The student pilot preflighted his T-38 and found no problems, so he started engines and taxied out for takeoff. The last chance maintenance inspection discovered a leaking main gear strut so the mission was aborted. Subsequent inspection revealed that the main gear strut was cracked.

FOD AGAIN

During post flight inspection, maintenance personnel found damage to nr 1 engine. The pilot had experienced no problems while airborne, and a check of the aircraft showed no fasteners or parts missing. There were no thread marks or other means of identifying the cause of damage. However, there are some possibilities. There were loose chunks of ice on the taxiways, and winter has caused some break up of the runway and taxiways. So as a precaution against blown objects, the unit involved has increased taxi spacing to 500 feet.

WRONG WAY

During preflight, an alert crew chief recognized that the ejection seat knee guard on a T-37 was rubbing the map case. Egress personnel found that the copilot's and pilot's seats had been transposed. The seats had previously been stenciled improperly, and the only difference between the seats is the knee guard position. The knee guard must be on the outboard side. If it is inboard it will strike the map case and possibly prevent a successful ejection. In adddition, the pilot does not have proper knee protection in this instance.

NO HOOK

The HH-1 flew a local instrument training sortie. During preflight the crew found no discrepancies, but after landing they discovered the hoist hook missing. The cable had uneven end strands and evidence of rust on the interior strands. Evidently air loads and oscillation caused the weakened cable to break. ★

the WINGS

MAJOR ROBERT L. GARDNER
Directorate of Aerospace Safety

"Military helicopter crashes . . . Chopper was on a personnel transport mission when radar contact was lost. No May Day call was received; however, ground witnesses reported the helicopter appeared to break up and come apart in the air. There were no survivors among the crew of four and fifteen passengers on board."

Does this news bulletin sound familiar? Unfortunately, several accidents similar to this have occurred in the past two years. And what is the first suspect? You guessed it—main rotor blade failure.

Rotor blade failure is not a common occurrence and investigators seldom find it to be the cause of helicopter accidents. But when it does happen in flight, the results are catastrophic: loss of control ending with total destruction of the aircraft. Because of the lack of an in-flight escape system, death is the probable fate of those persons on board.

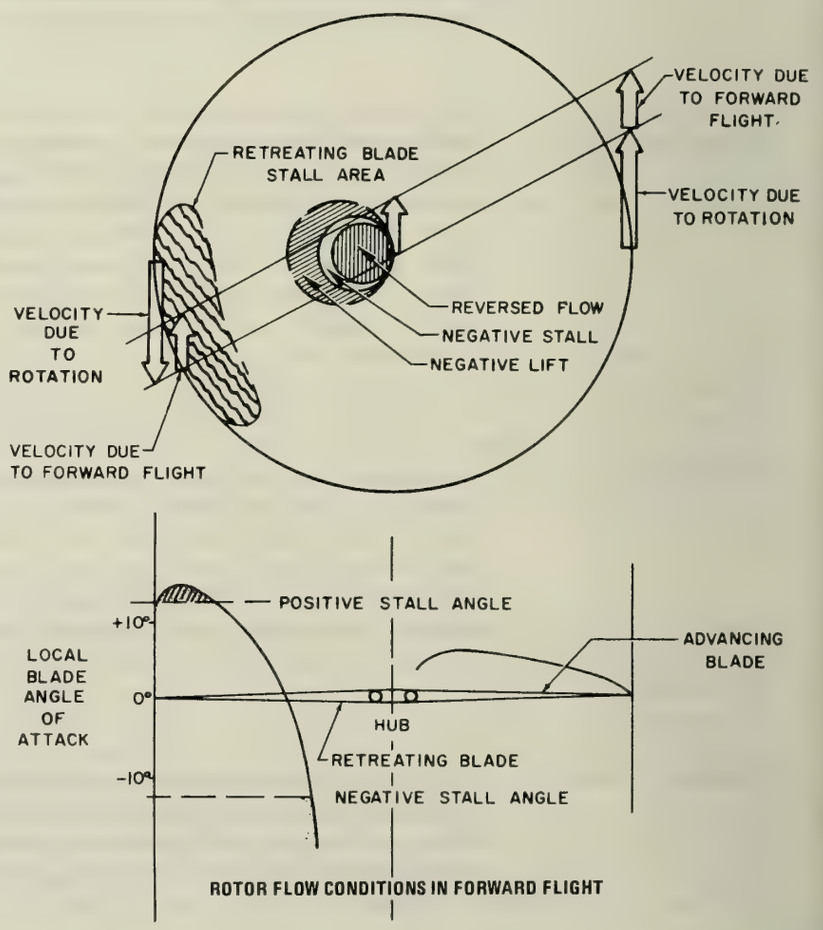
To a helicopter the main rotor blades are what the wings are to the conventional fixed wing airplane. The airplane derives its lift from a fixed airfoil surface, while the helicopter derives lift from a rotating airfoil known as the rotor. As you might expect, the word "helicopter" is derived from the Greek words meaning "helical wing" or "rotating wing."

Lift generated by the rotating wing enables the helicopter to accomplish its unique mission of hovering motionless in the air, taking off and landing in confined or restricted areas and autorotating to a safe landing following a power failure. But the generation of lift by a rotating wing is also responsible for some of the unusual problems encountered by helicopters. For example, let's briefly look at some of the different and varying forces which act on a rotor blade.

The first point to realize is that the rotor is subject to the same physical laws of aerodynamics and motion that govern flight of the fixed wing airplane. But the manner in which the rotor is subject to these laws is much more complicated due to the complex flow conditions.

Figure I illustrates a typical variation of blade angle-of-attack for various spanwise positions along the advancing and retreating blades of a rotor at high forward speed. There is a region of positive angles-of-attack resulting in positive lift over the entire advancing blade. Immediately next to the hub of the retreating blade there is an area of reversed flow where the velocity due to the forward motion of the heli-

FIG. 1
APPLICATION OF AERODYNAMICS
TO SPECIFIC PROBLEMS OF FLYING



ROTOR FLOW CONDITIONS IN FORWARD FLIGHT

OF A HELICOPTER

copter is greater than the rearward velocity due to the blade rotation.

The next area is a negative stall region where, although the flow is in the proper direction relative to the blade, the angle-of-attack produces a negative stall. Progressing out the retreating blade, the blade angle-of-attack becomes less negative, resulting in an area of negative lift. Then the blade angle becomes positive again, resulting in a positive lift region. The blade angle continues to increase until, near the tip of the retreating blade, the positive stall angle-of-attack is exceeded, resulting in the stalling of the tip section. This wide variation in blade section angles of attack results in a large variation in blade section lift and drag coefficients. The overall lift force on the left and right sides of the rotor disc are equalized by cyclically varying the blade pitch, but the drag variation is not eliminated. This drag variation causes a shaking force on the rotor system and contributes to the vibration of the helicopter.

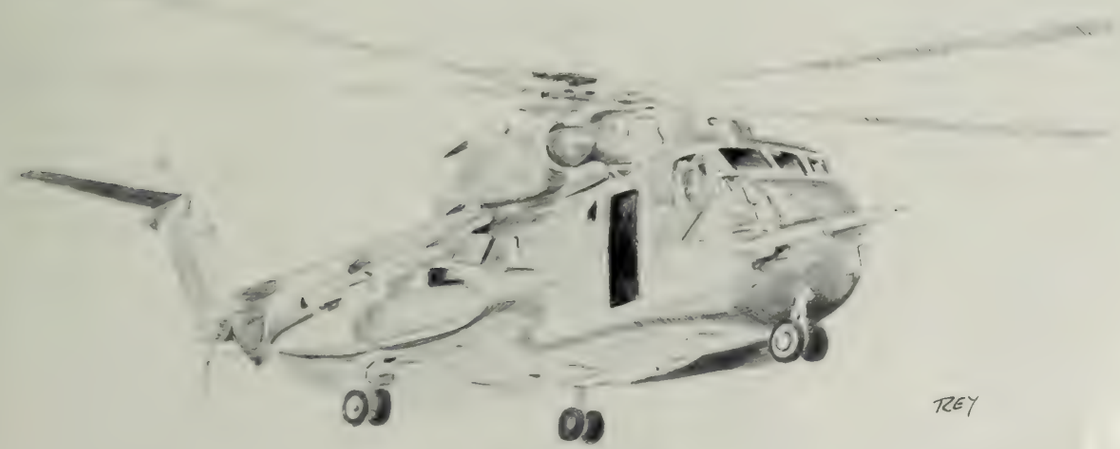
This continuous changing of lift and drag forces causes the rotor blades to flex and bend like a snake on a hot tin roof. This is vividly portrayed by viewing high speed motion pictures of a rotating blade.

The point is, helicopter main rotor blades are subjected to repetitive cyclic stresses. A small scratch, a tiny corrosion pit or inclusion on a blade spar can quickly induce a fatigue crack. Continued operation, particularly at high airspeeds will cause a spar crack to propagate and may result in failure in a matter of hours. Some helicopters have a blade inspection method (BIM) system which detects blade spar cracks. Other helicopters do not have a detection system and must rely on visual inspection to insure airworthiness. No matter what type helicopter, the maintenance and aircrew visual inspections are of primary importance in determining proper condition of the rotor blades.

Not long ago a blade was removed from an H-53 helicopter due to a *black* BIM indicator. At the overhaul facility it was noted that the blade possessed obvious lightning damage at the leading edge of number six pocket and at two places on the trailing edge of the same pocket. The lightning strike damage at the leading edge point had burned a small hole in the pocket and pitted the spar. Teardown revealed that the spar had cracked at the pit caused by the lightning strike. This blade was at the point of total separation which would have been catastrophic.

In-cockpit BIM systems will be installed in Air Force H-3 and H-53 helicopters. In addition a low stress rotor blade is being developed for the H-53. Incorporation of these improvements will enhance the spar crack detection and integrity of the rotor blades on these helicopters.

Although these modifications will provide additional safety factors, we must still rely on strict compliance with preflight and postflight inspections to detect damage and condition of blades. That is up to us. ★



THE B-1: FIRST FLIGHT

MAJOR MIKE BUTCHKO, AFFTC, Edwards AFB, CA



Now in its second year, the B-1 flight test program has been a carefully orchestrated combination of achievement and safety. The author describes some of the test program milestones and tells what's coming.



A major milestone toward modernizing the Air Force strategic bomber force occurred on 23 December 1974. That date marked the first flight of the Rockwell International B-1. A year later, 23 December 1975, the development program had accumulated over 110 hrs of flying time and was well on the way to opening the B-1 operational envelope. This article will cover the highlights of the first year's flight test activities, some of the unique safety controls applied to the B-1 program, and will take a look at the year ahead.

The first flight of a new aircraft is a tense and exciting event. All of the designing, manufacturing, ground testing and planning efforts are complete and everything is on the line. My feelings waiting to take off in a T-38 to provide photographic coverage of the first flight were at a level exceeded only by my first solo at pilot training. The B-1 flight profile, with a Rockwell pilot in the left seat and an Air Force pilot in the right, was actually quite conservative with the aircraft remaining in the takeoff configuration for the entire flight. The 1.3 hour mission verified the initial airworthiness of the aircraft and the engines. It also gave the pilots and engineers confidence in the handling qualities of the aircraft in the takeoff configuration. The mission was completely successful and a tremendous Christmas present to the entire B-1 Test Team.

With the first flight milestone accomplished, the B-1 was ready to begin envelope expansion in its primary low-altitude high speed operational environment. The first year's primary goal was to clear the aircraft for initial operation at 0.85 Mach at 500 feet.



PLUS ONE YEAR

The second flight was significant in that the landing gear, flaps, slats and wing sweep systems were activated for the first time. With the aircraft in a "clean" configuration, the flying qualities were given an initial evaluation out to 0.72 Mach at 16,000 feet. The crew then verified that the two auxiliary power units (APU) would start in flight.

Flights three, four and five expanded the medium altitude envelope to .75 Mach and 23,000 feet. APU assisted airstarts of the General Electric F101 turbofan engines were demonstrated. Of even greater significance, were the initial hookups with the KC-135 tanker for aerial refueling. No fuel was transferred during these hookups, but the capability to refuel in flight was validated.

The flight test program now moved west to the offshore test corridors of the Space and Missile Test Center (SAMTEC) and Pacific Missile Test Center (PMTC), where virtually unlimited airspace was available while still providing real-time telemetry of data to the Edwards Control Center. Flight six



All AF flight crew for B-1 Flt #16 being given final preflight briefing. L to R—[illegible] Richard Smith, Chief Joint Test Force Engineering, Col Emil Sturmthal, Pilot (JTF director), Lt Col Edward McDowell, Copilot, Mr. Pat Sharp, Flight Test Engineer.



THE B-1 continued



Joint Maintenance Concept—AF both evaluates and performs maintenance tasks. L to R—MSgt Stephen Saathoff, Rockwell Technician, TSgt Loyd Russell Bateman. NCO's are members of SAC 4200th Test & Evaluation Sq.

put the corridor to good use. Supersonic flight was achieved during the 6.4 hour mission; a top speed of 1.05 Mach was reached at 29,500 feet. The first "wet" hookup was made with the KC-135 during this flight and 53,000 pounds of fuel were transferred. Refueling is now a routine part of nearly every mission making valuable additional test time available. Fuel transfers in excess of 100,000 pounds have been made on a single contact and maximum in-flight gross weight of the aircraft has been achieved. These refuelings have made mission durations of over six hours a common occurrence in the program. Strategic Air Command tanker crews have provided invaluable assistance to the B-1 flight test effort.

The next phase of testing concentrated on flutter investigations to prove that the basic design of the aircraft would support low-altitude, high-speed flight. Flutter is defined as a dynamic instability of structural components, particularly on wing and tail surfaces. It is a very rapid vibration that can lead to catastrophic failure of the fluttering surface. These tests verify that the aircraft is flutter free throughout its operational envelope. Flights eight through 13 were primarily involved with these flutter tests. The operational envelope was opened to 1.25 Mach/29,500 feet at high altitude and .85 Mach/3000 feet in the low altitude environment. Flight eight was particularly significant in that it marked the initial maximum gross weight takeoff of the aircraft.

The higher-faster and lower-faster pursuit continued. An all-Air Force crew flew for the first time on flight 16. Flight 17 reached 1.4 Mach. The initial goal of the first year's testing was achieved on the 18th mission. The B-1 flew at .85 Mach at 500 feet over the SAMTEC offshore range on 9 October 1975. A 7 hour and 52 minute flight 19 was the first of a continuing series of low-altitude, high-speed overland flights. Thus far these flights have ranged from 500 to 2000 feet above ground level (AGL) and have served two important functions. First, they provide valuable information on pilot workload and aircraft response in the terrain following mode of operations. Second, the Structural Mode Control System (SMCS) is being given a thorough operational evaluation. The SMCS is designed to smooth the ride by damping out the effects of turbulence. Without such a system, operating an aircraft as large as the B-1 at high speeds and low altitude could be severely limiting to crew performance. It would be similar to trying to fly an accurate ILS approach in a thunderstorm.

In addition to the low altitude work, the next series of flights, 20 through 24, began the step-by-step move toward the secondary mission of the B-1. This is the high-altitude, high-mach mission. Supersonic flutter and propulsion tests have begun. To date the B-1 has achieved 1.6 Mach and 50,000 feet.

Flight 25 concentrated on the more routine aspects of testing. It gathered data on subsystem and aircraft performance to start filling in the details of the center of the operational envelope. While not as exciting and as glamorous as envelope expansion, these tests are equally important. They lead to determination of optimum flight conditions — best climb schedule, best cruise mach/altitude, etc.

The flight test program has been extremely successful thus far. Some problems have cropped up and not all missions went exactly as planned. But these occurrences are commonplace in the development of new aircraft. The important thing is that as each problem has surfaced, a fix has been determined and the corrective action taken. The aircraft has not been exposed to any unnecessary risks. In fact, the high level of interest in the B-1 has resulted in a very comprehensive safety program that is worthy of further discussion.

The old cliche, "Safety is paramount," has had particular significance to those of us involved in the B-1 program. While the loss of any aircraft is significant, the loss of the only asset currently flying in the test program would be catastrophic. With this in mind, the safety controls for the B-1 have been stringent.

The readiness for the first flight and its profile were reviewed at the highest levels of Air Force Systems Command (AFSC) and USAF through independent first flight readiness review teams. NASA conducted a month long system safety

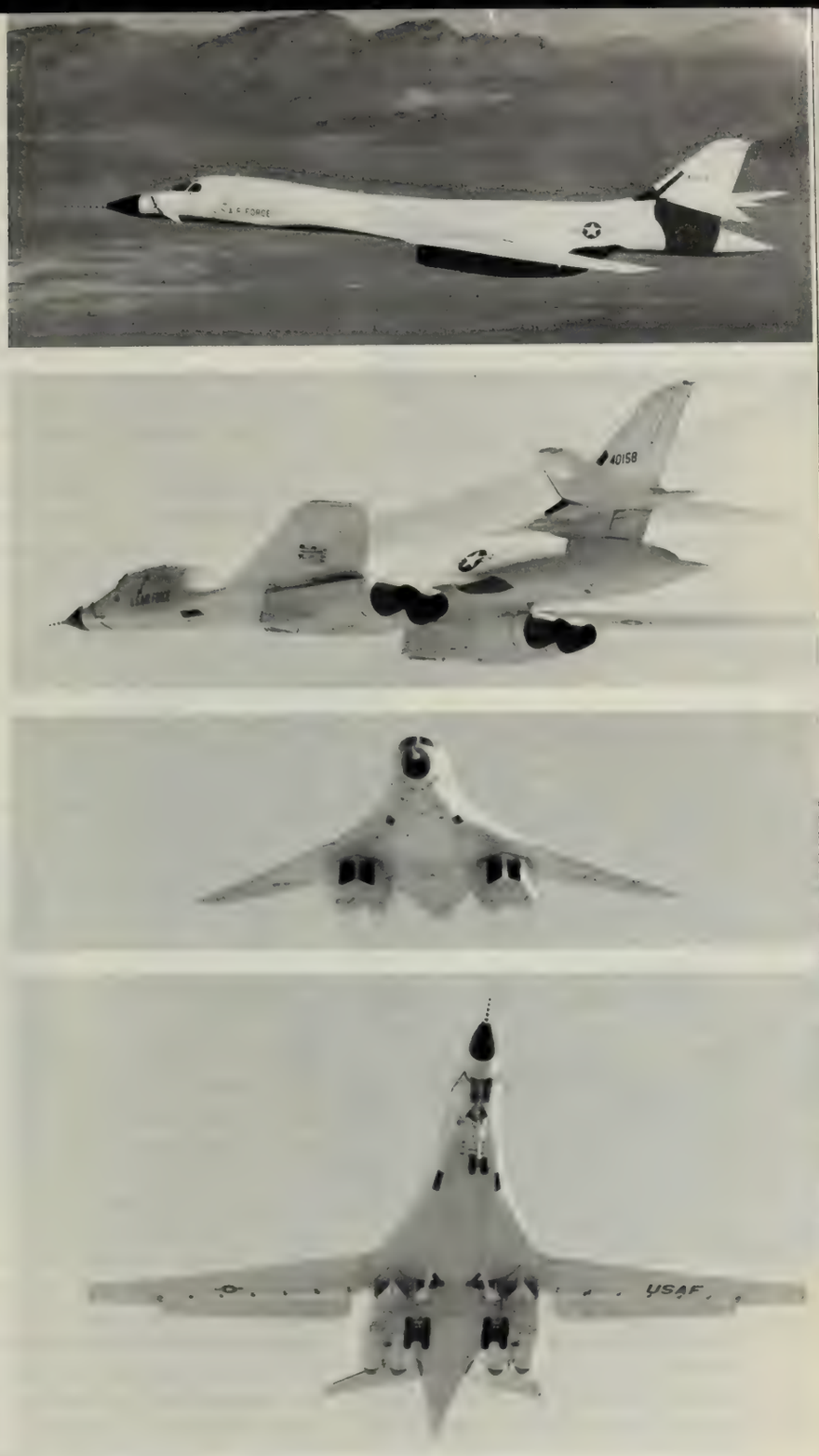
review. AFSC directed an Executive Independent Review Team. Finally, the Air Staff implemented a study called Corona Quest to verify that the aircraft and aircrew were ready for first flight. These studies were in addition to the in-house reviews held by the System Program Office (SPO), Rockwell International (RI), and the Air Force Flight Test Center (AFFTC).

To some, it might seem that we have had an excessive amount of "help." But it must be kept in mind that the B-1 is a very high interest program. The production decision for the B-1 is yet to be made. The members of the Defense System Acquisition Review Council (DSARC) and the Congress need flight test data to make an accurate assessment of the B-1's readiness for production. With only one B-1 to provide the data for the first year, no valid safety input could be considered excessive. Or stated more simply: no aircraft, no data and no production decision! Neither the program nor the nation could afford to lose the first B-1 aircraft.

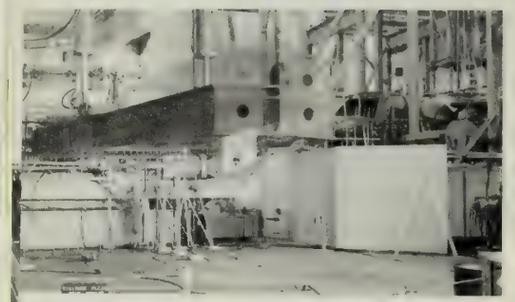
The crunch comes in sorting out what is necessary and what is excessive in terms of constraints. We need the maximum number of milestones accomplished. Each milestone involves envelope expansion. Envelope expansion is by its very nature a hazardous undertaking. The job in the B-1 program is to control the hazards and keep the risks down to an acceptable level. The earlier and the on going efforts have done this and are continuing to do so. Some of the efforts are standard to all test programs. Some are unique to the B-1 program. I will briefly mention two that are unique.

The first involved an Air Staff interest in the physical condition of the flight test aircrews. Both the contractor and the Air Force crew

continued



Series of photos show various aspects of B-1 flight test program. Top and bottom photos show swing wing in different positions.



Wing pivot test at LTV laboratory. Hydraulic rams put vertical and torsional loads on dummy wing box attached to pivot.

members have to have a complete physical within 60 days of their first flight in the aircraft. In addition, a physical screening of each crew member is conducted by an Air Force flight surgeon prior to every flight.

The second unique aspect deals with the test operations. All new test aircraft are initially required to operate in VFR conditions and with a safety chase aircraft in close proximity. The B-1 also operates under these same restrictions. In addition, the B-1 is restricted to positive control airspeed with radar separation provided from all other aircraft not directly involved in the B-1 formation. This restriction, while sometimes inconvenient, imposed no significant restraint on the number one aircraft. However, the restriction is being reviewed for possible modification to allow for operation of the number three aircraft in the terrain following environment.

The major difference between the B-1 safety program and that of other programs is the level of "between flight reviews." Test plans for all aircraft tested at Edwards undergo the scrutiny of the AFFTC Safety Review Board before testing can start. The B-1 review process goes further. To implement an Air Staff requirement of "continued reviews," a formal operations/safety review panel was formed to assess each planned flight. I chair the panel which is composed of members representing the B-1 Joint Test Force, AFFTC Engineering, AFFTC Safety, the Contract Management Office, and Rockwell Safety. Our charter is to ensure operational and safety readiness for each flight. This is done by looking at the previous flight's results in light of how they support the objectives of the upcoming flight. The review panel concept has been quite successful and has provided vaulable recommendations in specific test areas to control the level of hazard involved in the tests.

The second year of B-1 flight test will undoubtedly see some modifications in the safety program since the test program itself will change significantly. Aircraft one will continue to lead the way. The third aircraft will fly in late spring, while the number two aircraft will start flying during the summer. The apparent disparity in numbering stems from the fact that the second aircraft spent several months undergoing extensive structural loads testing in a special test facility at Palmdale, CA. The combined performance of all three aircraft will hopefully lead to a favorable production decision in November 1976.

Aircraft number one will continue to do extensive performance and flying qualities tests. These tests will expand the aircraft envelope to Mach 2+ and above 50,000 feet. They will also further define the low altitude high speed area of operations. Initial weapons separation tests will be conducted on aircraft one. The weapons tests will verify that the weapons will separate cleanly from the aircraft. They will not be assessing the accuracy of the drops. Accuracy measurements will be left to aircraft three through simulated weapons releases as part of the avionics demonstration. Full weapons certification will follow the production decision.

Aircraft three will be the offensive avionics testbed. It will provide the initial demonstration of the capabilities of The Boeing Company's offensive avionics system. In addition to simulated weapons deliveries, the avionics demonstration will include navigation systems development tests and terrain following (TF) development tests in both the manual and automatic modes. TF testing will follow the same step-by-step progression as other envelope expansions while working toward maximum speed at minimum terrain clearance.

Aircraft two also has a specific task. It is especially instrumented for structural loads measurements. Having successfully completed the ground loads tests, it will fly specific test profiles toward clearing the B-1 for 100 percent of design structural in-flight loads (g-loads). Air loads will be gradually increased until the design limit is reached to verify the aircraft's basic design. Only an initial investigation will have been accomplished by November 1976, but it will be sufficient to identify potential problems that might be present.

The first year of B-1 flight testing is complete and the results are impressive. However, a major effort lies aehad. If the second year is as successful as the first, a decision to produce the B-1 should be made by the DSARC. The goal of the B-1 Test Team is to ensure that success so that the proper decision can be made. Success will not come from luck but will result from a continuing aggressive safety program to control the level of the hazards involved while achieving the maximum number of milestones. ★

Major Mike Butchko presents an historical summary of the first year of B-1 flight testing. His discussion of flight test milestones, as well as an analysis of the flight safety program, provides an in-depth analysis of the highly visible thresholds the B-1 is expected to achieve prior to production decision. Major Butchko, a 1962 graduate of the United States Air Force Academy, received his MS from the University of Southern California in 1974 and is presently the B-1 System Program Office's test representative for Flight Operations and Flight Safety at Edwards AFB, CA. He is a 1971 graduate of the United States Air Force Test Pilot's School and possesses operational expertise in flight test development. The editors of Aerospace Safety *Magazine are most appreciative of this contribution.*

LT COL DAVID E. RALEY
Directorate of
Aerospace Safety

THE FSO



Photos by Aerospace Audio-Visual Service, USAF
Anyone who has spent time on the flight line knows the FSO, but few realize all the things he gets involved in. Here Major Franklin Lamb, FSO at Vandenberg AFB, lets the tower know the approach lights are functioning properly. Only one of the many ways he helps you.

It seems like the only time we see those guys is when something has gone wrong and they are asking "why?" Trying to stick it to some innocent young jock just because he ran over that yield sign out there in the runway clear zone. It doesn't matter that he was 400—500 feet low on his final approach, the manuals say you cannot have anything like that in the clear zones. Why is he down here talking to us? Why doesn't he go up and hassle the civil engineers? They are the guys that put the sign there.

That's the side of the Flight Safety Officer we most often see and remember the longest. But FSOs do a lot of other things, depending on the individual and his involvement.

Let's take the hazard reporting program (AFR 127-6). You are upset with maintenance because they cannot seem to fix the afterburner on 007 and it's caused you a couple of hairy moments. You've written it up several times in the 781, but it's still not fixed. You call for help by submitting an HR (AF Form 457).

Who now, becomes your advocate with the maintenance people? It's the FSO who was just down hassling you. He will work to ensure the problem gets to the right person and keep checking on it until it's fixed. He will then let you know what has been done. He is now a good guy in your eyes, but what about the maintenance folks? Oh well, it doesn't matter, they will need help too and ask for it by submitting an HR on some problem that just does not respond to the normal system. The friendly FSO is now a helper and this is a very rewarding and challenging role.

Now, the FSO has to ensure that the aircraft accident prevention program is responding to all the areas which can cause a mishap or create problems for the aircrew, aircraft maintenance people or anyone else associated with flying.

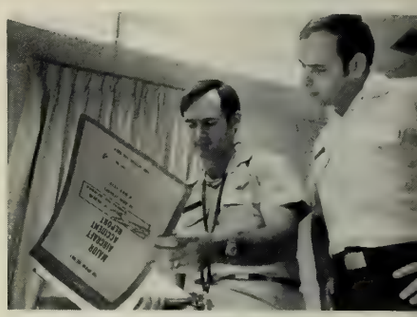
The FSO spends a great deal of his time working with the civil engineers on airfield problems—aircraft arresting barriers, runway and taxi markings, clear zones, pavement maintenance, etc. You name it and an FSO has been involved with it some time or another.

The air traffic control area re-

continued



Captain Richard E. Simmons, Scott AFB FSO makes regular visits to the control tower. Recently he talked with Captain Amanallah Yazdanpanah, an exchange officer from Iran who is training to become a controller in his country.



Dr. Gerald B. Pees, Hickam AFB Flight Surgeon, discusses medical aspects of an aircraft incident with FSO Captain Henry McPhillips.

THE FSO

continued

Runway construction is the subject of a conversation between Hickam AFB FSO Capt Gerald H. Lannoux, Col Henry G. Snider (Left), Civil Engineers Commander, and Col W. E. Y. Paxton (Right), Base Commander.



Captain Henry McPhillips, Hickam AFB FSO, checks on stock level of a vital part with Mr. Bunny Tong, 15th Supply Squadron.





Maintenance man TSgt Fred Schlosser points out repaired item in cockpit of a T-33 to Capt Henry McPhillips.

quires a lot of his attention—GCA, taxi routes, traffic patterns, navigation facilities, etc. He is usually a member of the local air traffic control board and, along with the other members, is constantly seeking to identify problems and correct them before something bad happens. Many FSOs have been instrumental in the development of programs to brief the local civilian pilots on military aircraft operating areas in an effort to avoid "air misses."

A good FSO spends some time in supply and usually has some pretty good contacts there. The typical supply organization is run very efficiently and provides the needed items in a timely manner. But occasionally, there arises a problem which you just cannot seem to solve and you have exhausted all the normal channels. If it is causing you problems and is interfering with safe mission accomplishment, give the FSO a crack. Sometimes his shorter and frequently informal communications channel can get the problem to the right person for a quick solution. Other times—?

The FSO learns quickly that the flight surgeon is one of his best friends and a very important ally in his accident prevention activities. When he runs into some "human" problems that he does not have answers to, he can usually get the flight surgeon to help him out. Besides, the flight surgeon has to do all the paperwork when preparing the physiological incident (hypoxias, decompressions, etc.) reports which seem to pop up now and then. Personal equipment anomalies are frequently involved in these in spite of all the emphasis that this subject receives. The FSO can be seen visiting with the life support people to help them provide the support the aircrew members need in the personal equipment area.

What about aircraft maintenance? The FSO spends a lot of time in this area due to the nature of the aircraft incident reporting system. Hardware failures are usually specific and concrete, and when one occurs that meets the reporting criteria, we have a "reportable" incident. The FSO is then tasked to ensure the report is prepared and submitted properly.

Many times he does the investigation and reporting himself, although some reports are done by quality control or someone else. In any event, the effort will receive a great deal of outstanding support from the maintenance supervisors and the quality control people. Also, with any kind of luck their coordinated efforts will result in some changes and in the long run fewer aircraft safety problems. Unfortunately, it does not always seem to work that way and as one problem is solved another appears. Oh well, this gives the FSO an exceptional opportunity to work with a lot of great maintenance people; and he will know them better when he comes around to them with their other safety problems.

Above all else, the FSO is an aircrew member and usually a darn good one. He is active with the flight operations guys and pulls his share of the bad duty along with the good. He's going to find rough going if he is the type who misses the night low altitude training missions or flare drops, but is always there for the gunnery sorties or trips to Japan. It's pretty hard to make your point when you haven't been there yourself.

The FSO is in a unique position in that he can look at the whole operation in an objective manner. And if he reads his boss, the wing commander, right he can look at it from the boss' perspective. The wing commander and his safety staff are about the only ones in the unit who do not have some parochial interest in one of the functional areas. It's a great job, and the FSO really gets to see how things go—good and bad.

P.S. His job is to solve problems for the wing, not create them. If that's not the case, well—. ★

THE IFC APPROACH

What assigned altitude can I expect in a departure clearance?

A: ATC will assign an altitude based on availability, using the following order of precedence:

a. The altitude filed in your flight plan;

b. An altitude in the route stratum filed in your flight plan and as near as possible to the altitude filed; (NOTE: Route strata: High, above FL 450; Mid, FL 180 to FL 450; Low, below FL 180.)

c. An interim altitude within the route stratum filed in the flight plan or an altitude as near as possible to the route stratum filed. Also, ATC will inform you when or at what point to expect clearance to the assigned enroute altitude. Example: You have filed for FL 350. FL 230 is immediately available and FL 350 will be available ten minutes after departure or at a specific fix. The clearance will read: "Maintain Flight Level 230, expect Flight Level 350 ten minutes after departure" or "Maintain Flight Level 230, expect Flight Level 350 at the San Antonio Zero Three Three Radial, Two Four DME fix." If you experience radio failure, before receiving clearance to the expected altitude/flight level, climb to the expected altitude/flight level at the time or fix specified in the initial clearance.

Caution should be used if the final or expected altitude is lower than that used for flight planning. Do you have sufficient fuel to complete the flight to destination at that altitude, in case of radio failure? If you don't have enough fuel, request a delay until a suitable altitude is available or until ATC advises when or at what point a higher altitude will be available.

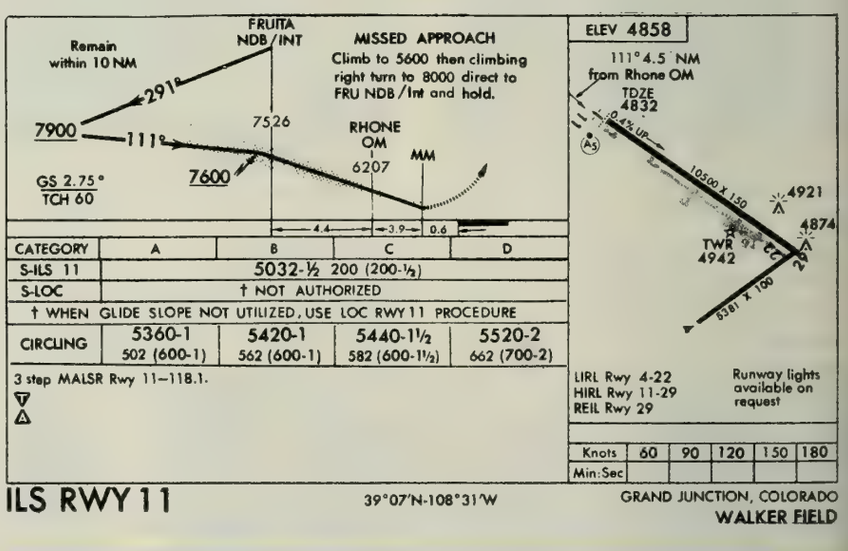
PILOT CONTROL OF AIRPORT LIGHTING

A new device is being installed at some airports which are manned less than full time. Controls are installed that enable pilots to turn on some airfield lighting systems by selecting a communications frequency and then keying the mike. Control of these lighting systems will be possible when the aircraft is within 15 miles of the airport.

The types of lights and frequencies are published on the Instrument Approach Procedure chart beneath the minimums block. Our example, Figure 1, lists a 3 step, Medium intensity Approach Light System with runway alignment indicator lights (MALSR) for runway 11. The activating frequency is 118.1.

The legend pages in each low altitude approach booklet list the number of times to key the mike to turn on either the high, medium, or low intensity of the lighting system. How would you like to be on short final after selecting low intensity and have another aircraft activate high intensity? Could be a surprise at a time when you don't really need one. BE AWARE!

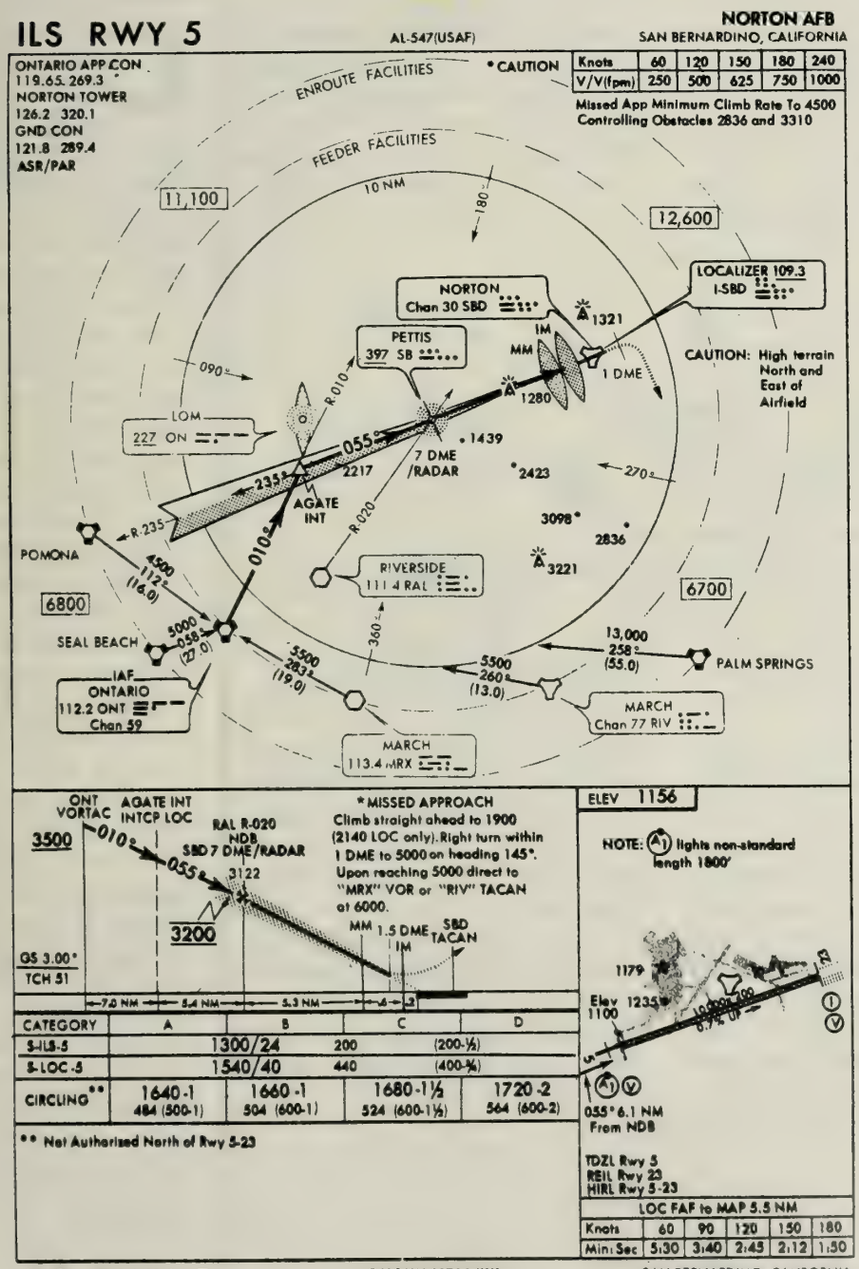
Further explanation is contained in FLIP, IFR Supplement, Procedures Section and in the FAA Airman's Information Manual which you can find in USAF Base Operations.



What should a pilot do if he must execute a missed approach prior to reaching the missed approach point (MAP)?

A: Missed approach protected obstacle clearance areas are designed with the assumption that the missed approach will be started at the missed approach point. When it is necessary to execute a missed approach prior to the MAP, pilots should, unless otherwise cleared by ATC, start a climb and continue to

fly the depicted ground track to the missed approach point. Then, execute the missed approach procedure. An example of what could happen if you made an early turning missed approach is the ILS approach to Runway 5 at Norton AFB. (See Fig. 2) On this approach an early turn may cause you to come dangerously close to the terrain and obstructions depicted to the south and southwest of the aerodrome.



LOST COMMUNICATIONS—ENROUTE

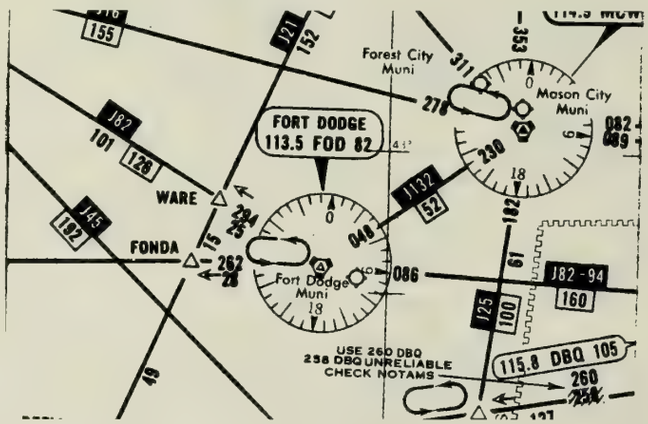
Q: If a pilot experiences radio failure after he has been given an en route clearance limit and an expect further clearance time, what actions does ATC expect when he reaches the clearance limit fix?

A: *If no holding instructions have been received,* proceed, without holding, by either (1) the route assigned in the last ATC clearance received, (2) in the absence of an assigned route, by the route that ATC has advised may be expected; or (3) in the absence of an assigned route or a route that ATC has advised may be expected, by the route filed in your flight plan.

Q: When and how will ATC specify en route holding?

A: Holding instructions will be given anytime a delay is required prior to further clearance being issued. If a holding pattern is depicted at the clearance limit, ATC will issue the direction to hold and the time at which the pilot may expect further clearance. Example: "RAMA 01, CLEARED TO THE FORT DODGE VORTAC, HOLD WEST, EXPECT FURTHER CLEARANCE AT 2130Z." (See Figure 3) When no holding pattern is charted for the clearance limit, ATC will issue *general* holding instructions or, detailed holding instructions, if requested by the pilot or considered necessary by the controller. These instructions should be given at least five minutes before you reach the clearance limit. ATC should also specify a time at which you can expect further clearance.

Figure 3

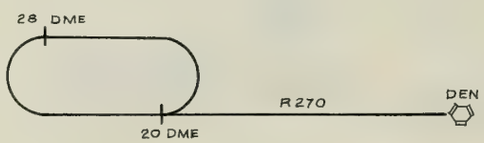


Q: What information is contained in "general" and "detailed" holding instructions?

A: General holding instructions will specify: (1) direction of holding from the fix; (2) the holding fix; (3) the radial, course, bearing, airway, or jet route on which you are to hold; (4) Outbound leg length in miles, if DME is used; (5) direction of holding pattern turns, if left turns are to be made. Example: RAMA 61, HOLD WEST OF THE TWO ZERO MILE DME FIX ON THE DENVER VORTAC TWO SEVEN ZERO RADIAL, EIGHT MILE LEG, LEFT TURNS. (See Figure 4)

Detailed holding instructions are the same as general holding instructions except the controller will *always* specify the leg length in minutes or miles DME and the direction of holding pattern turns. ★

Figure 4 HOLDING INSTRUCTIONS



KEEP IT ON THE RUNWAY—F-4

LT COL J. P. CLINE
Directorate of Aerospace Safety



Let's start out with the premise that the airplane rolls better on paved surface than in the weeds. Then, a second premise can be that we commonly encounter situations which cause us to lose directional control on the runway. These situations include crosswinds, hydroplaning, blown tires and hardover nose-gear steering.

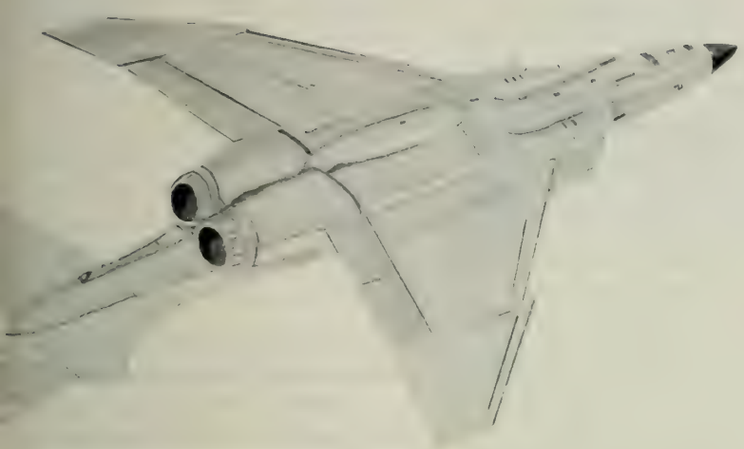
The new Mark III antiskid will give us locked wheel protection—in other words, the brakes aren't applied until the wheel comes up to speed, even if our clodhoppers are on the brake pedals at touchdown. BUT—Mark III isn't the answer to all brake problems. We will still see some blown tires so don't get too relaxed. You still must be prepared to keep the beast on the runway. Even though the nose-gear steering established its lack of reliability early in the life of the F-4 and still leaves a lot to be desired today, it is still probably the best means of staying on the runway with a blown tire. Most people avoid nose-gear steering problems by avoiding use of the nose-gear steering. BUT—don't confuse normal procedures with emergency procedures.

"NOSE-GEAR STEERING—ENGAGE" is the first bold face step in the blown tire procedure, but it is surprising how many jocks run off the runway without engaging it. Remember, the famous old axiom—use everything available to stay on the runway. ★

★ ★ ★ ★

DOWN! EDISPU and out of ideas?

MAJ ANTHONY HELBLING, JR.
Directorate of Aerospace Safety



SITUATION: For one reason or another, you find yourself inverted and stalled.

There has always been a tendency for this attitude to progress to an out-of-control condition. This may be due to disorientation and/or (unfortunately) the wording of the bold print procedures. The problem is that our bold print responses are oriented right-side-up with respect to earth's gravity. The usual "Stick Forward" response works great *most* of the time, *except* while inverted.

Over the past several years, we have had crews depart inverted while attempting advanced handling or confidence maneuvers in the F-4. In a typical situation the stick was positioned full forward in an attempt to unload the aircraft. Instead, the pilot loaded the bird and kept it in a stalled condition until the mandatory bailout altitude or extreme confusion resulted in ejection.

This type of control loss is common to fighter/trainer aircraft during confidence maneuvers, advanced handling, and BFM/ACM maneuvers. It is, however, germane to any bird with wings. Many of our bomber and transport aircraft have bold print procedures for upright out-of-control; whereas the inverted departure is not addressed because the occurence is remote or the military specification for that particular handbook does not require the procedure due to aircraft type.

Various technical journals published by several aircraft companies, such as McDonnell Douglas' *Tiger Talk,* recommend removing the "meat hooks" from the controls in a disoriented situation. This should prevent aggravating the unknown flight condition. Good advice! . . . provided it doesn't *directly conflict with the Dash One.* The rationale for the above is: a stable aircraft will seek level flight (assuming it was trimmed for it) with the 1 G (pull of gravity) doing the work for you. This works every time, provided terrain clearance isn't a factor and the aircraft hasn't fully departed controlled flight, (needing anti-spin inputs to regain control).

Those of us with the advantage of an angle-of-attack (AOA) indicator can identify a "loaded" versus "unloaded" condition and prevent a negative G stall. However, this gage has been misinterpreted by some crews during violent departures.

A good many of our losses have occurred in the training environment (student/instructor combination). Many cues are available for a proper recovery dependent on instrumentation and aircraft type. In the F-4, there are two heads and chances are one of them is less disoriented than the other. It really pays to discuss situational emergency procedures before each flight and tailor them to the maneuvers being performed. When it happens—it's fast and disorientating! You've got to have a plan. It's now too late to talk it over with your Fightergator!! ★

MAJOR BRIAN C. BERNET, CF
Directorate of Aerospace Safety

LOST ...on a circling approach...



Have you ever flown an approach when the weather was down to minimums? Have you had that elated feeling of success, of pride in your ability to make your airplane do just what you want—to perform the perfect instrument approach when it's for real? You probably have if you have done any amount of operational flying.

I expect that most of your approaches in poor weather were precision-type approaches, either ILS or GCA. With these the runway should be at 12 o'clock and rarely is there any doubt about which piece of pavement to land on! However, occasionally a circling approach is required. This means that you do not have the comfort of knowing you are lined up with the landing runway from many miles out. Instead, there may be a frantic search for the proper runway while performing a visual procedure, probably in marginal weather.

If you are unlucky enough to be doing this at an unfamiliar airfield, you may find out what others have found before you; that it is not always easy to find the proper runway for landing.

Not too long ago an IP touched his airplane down on a taxiway. We were fortunate in that case that a tug operator saw what was about to happen and stopped his vehicle instead of entering the taxiway! This is not the first time someone has landed on the wrong part of the airpatch. If we don't keep our wits about us, it won't be the last.

There were perhaps some mitigating circumstances in that case. The taxiway has better contrast with the surrounding environment than does the runway, and the presence of aircraft alongside the taxiway attracted attention to it. However, that airfield is not the only one to cause confusion and the pilot should have been prepared.

There are several basic problems in performing a circling approach to an unfamiliar runway environment; one is the real possibility of choosing the wrong strip of pavement when there is more than one from which to choose. You can prevent this if you check the aircraft heading on final to verify you have the correct runway; just the same as checking runway heading before takeoff to be sure you haven't lost your way taxiing out! Also check the runway numbers to be sure you don't have the parallel taxiway.

There are other things worth remembering about circling approaches. Study the airport layout given on the approach chart before you begin your approach. Don't lose sight of the runway environment; not only can it mess up your approach, but you may be

outside your safe terrain clearance limits. Don't bend your airplane too tight around the corners of the pattern. This is for the same reason as flying the proper airspeed. Your flying machine will stop flying if you don't treat it right. If circling at night, remember those beautiful bi-directional runway lights you probably saw as you broke out at minimums. When you get at 90° to them on downwind, you may not see them anymore! So keep alert.

One final word, a circling approach is a visual procedure. As soon as you have joined the normal flight path for a visual pattern, fly your airplane as you would on a VFR day.

Having just alluded to the weather being suitable for contact flight, I realize that it could deteriorate in the latter stages of a circling approach. You should be mentally prepared for reentering cloud and should know in advance what your actions will be. Remember, when commencing missed approach, your first turn should be toward the runway (Reference AFM 51-37, page 15-16). A missed approach from a circling approach may involve a complete reversal of direction, several minutes of flying and considerable maneuvering at low level, which could be in cloud. If a missed approach is possible, have a course of action ready in your mind before you start to circle. Immediately upon going this approach, tell ATC what your intentions are. This will allow them to protect altitude and airspace and maintain separation between you and following aircraft.

Circling approaches are often complicated by poor visibility and other traffic. Not only must you keep the airfield in sight while avoiding aircraft and rock centered clouds, but you must be sure you have picked the proper runway! ★

OH..OH!

WING COMMANDER MARK PERRETT
Royal Australian Air Force
Directorate of Aerospace Safety

When a T-39 lost cabin pressurization while cruising at 39,000 feet, the master caution, cabin pressure fail, and pressure duct fail lights all illuminated and cabin pressure steadily climbed to 39,000 feet.

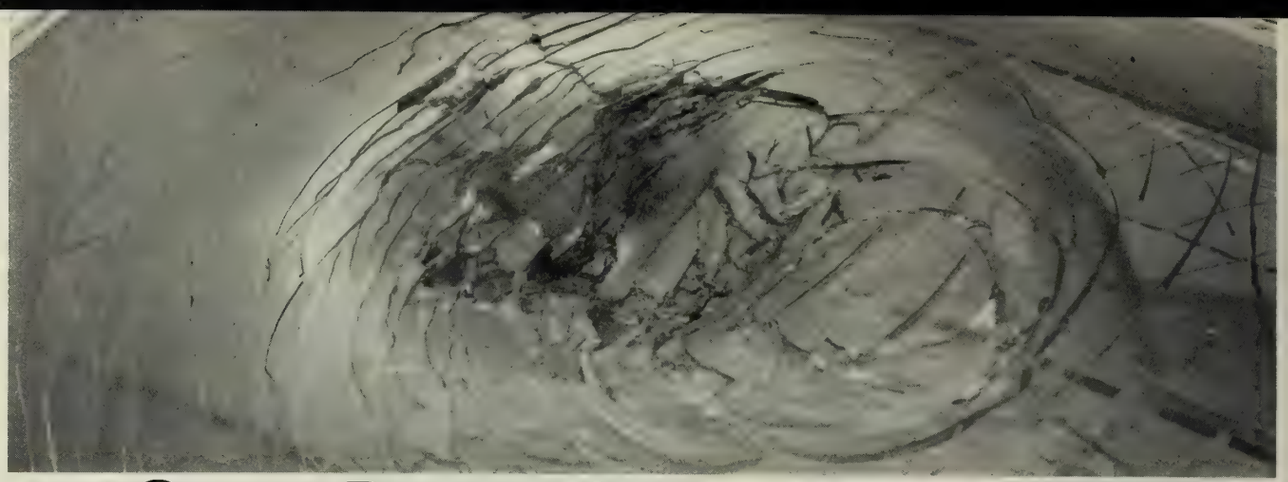
This occurrence highlights a number of considerations that T-39 pilots should keep close to the surface of their memories:

- When cruising at flight level 390 or higher, remember that a cabin depressurization will leave you, and your passengers, at a height where you need *pressure breathing,* even with a perfectly fitting mask. Not even Super Optimist could consider passenger oxygen masks as nearly perfect fits.
- In such a situation, knowing the Bold Face action is not enough. You need to improve cabin environment *immediately* by initiating an emergency descent (to 25,000 feet).
- Don't wait to receive descent clearance from ARTCC — but tell them immediately that you are descending. Maintain visual flight conditions if possible.
- Consider that 25,000 feet is your maximum altitude available, but a 10,000 foot cabin altitude is preferable. AFR 60-16 Chap 6 para 5b(3) states "descent will be made to a point where cabin altitude can be maintained at or below 25,000 feet." MAC supplements this paragraph to read "descend to 13,000 feet or minimum altitude, whichever is higher." Terrain, navigation aids, flight range, flight conditions and positive radar control (with flight separation) are all factors which may influence your decision.
- The possibility of depressurization should reemphasize to pilots that checking your sweep-on mask is not a gratuitous act—it is vital. Not only does it guarantee oxygen supply when needed, but it will verify that a transmit capability using the mask microphone exists.
- Don't be cursory in your treatment of the passenger briefing regarding oxygen masks. Passengers must have a clear understanding of just what they have to do. You or your copilot may not have time to get back there and monitor their actions.

None of these thoughts is new. They summarize what your thoughts should be on encountering this surprising, and confusing, situation. ★

CONGRATULATIONS—67th Tactical Reconnaissance Wing Commander Col George M. Sauls congratulates Capt Steve Eisenberg (inside L) and 1st Lt Larry Hensen (inside R), while Deputy Commander for Operations Col George R. Hall (extreme L) and 12th TRS Commander Lt Col Dewey K. Hemphill look on.





Crew Protection

LT COL FRANK B. PYNE, Directorate of Aerospace Safety

Cockpit enclosures that provide aircrew protection from bird impacts will be standard equipment on USAF aircraft in the near future. Retrofit programs are underway in some older weapon systems, and new aircraft entering the inventory are equipped with bird-resistant transparencies.

Since 1962, the USAF has experienced 14 major accidents which resulted in five fatalities and aircraft destroyed from birdstrikes which penetrated some portion of the cockpit enclosure. F-111s account for the largest dollar loss with five aircraft destroyed, while T-37s and T-38s account for all the fatalities.

Birdstrike statistics indicate that 90 percent occur below 1000 feet and involve a bird weighing four pounds or less. Statistically, we can expect 11.56 percent of all birdstrikes to be on the cockpit transparency.

In an attempt to eliminate the fatalities and reduce the dollar loss, an extensive R&D program has been conducted to provide protection from birdstrikes for these aircraft. A by-product will be bird protection for all aircraft in the future. Like all things new, some education of the users and maintainers will be required if we are to obtain the benefits and avoid the pitfalls.

Many types of materials were examined and tested to obtain the desired bird impact resistance, optical quality and maintainability. Polycarbonate is the material presently available that will absorb the tremendous impact forces and not fail catastrophically. Polycarbonate is sensitive to environmental abrasion, difficult to manufacture in quantity and cannot be ground or polished to control optics.

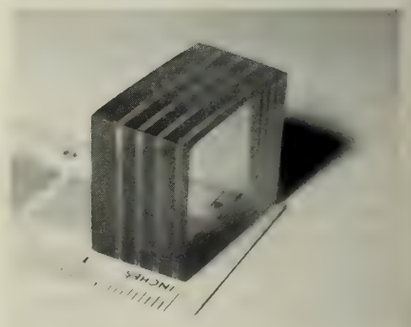
To provide protection from environmental abrasion, a scratch-resistant outer layer must be provided. The material used for the outer layer depends on the optical requirements, weight restrictions and the company manufacturing the parts. Glass provides the most protection but adds the most weight. Acrylic is used for some installations, and a thin "hard" coating is used on others. Except for glass, all are subject to surface scratching and cannot be polished to remove surface scratches.

These qualities will greatly reduce service life compared to glass unless both aircrew members and maintenance personnel, are aware of the care and feeding required. With the high cost of replacement parts and industry's present limited

Sled test of new bird resistant material for aircraft windscreens. Hole in windshield was made by test bird, mark just above nose leading edge was made by a trespasser who flew by at the wrong time.



Piece of laminated polycarbonate bird resistant windshield cross section. T-37s are now equipped with windshields made of this material.



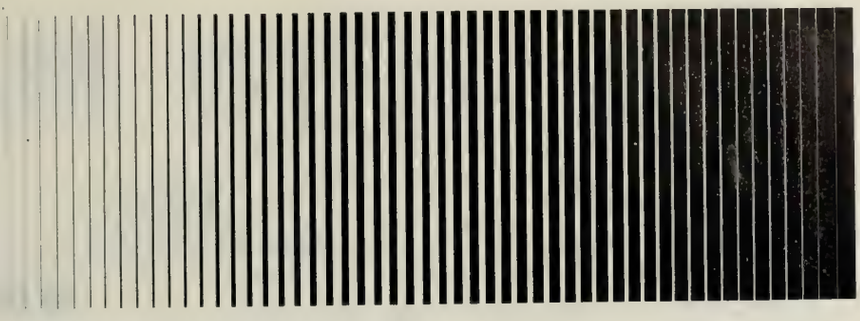
capacity to produce aircraft quality polycarbonate in quantity, it is easy to see that we are going to be flying with scratched transparencies or be grounded awaiting replacements.

The same quality that resists bird impacts also makes it impossible to break with a fire ax or canopy breaker tool. Crash and rescue people must be aware of and have the proper tools to saw through the transparency, if required.

In flight, safely behind almost an inch of glamorized plastic, aircrew procedures should remain unchanged from those presently in use. All bird-resistant designs are based on the "catch" principal. That is, to absorb the energy and keep the bird out of the cockpit. This can mean as much as six to eight inches of deflection in the transparency when a bird is impacted at high speed.

Although cockpit enclosures have been redesigned to provide some flexibility for canopy and windshield supports, deflections of this magnitude will dislodge items in the cockpit and reduce the combining glass on optical sights to relatively high velocity debris. Therefore, visor requirements should not be changed. Since the bird cannot always be relied upon to impact near the center of the transparency and the amount of flexibility is limited near the edges, some tearing and bird penetration can be expected if impact occurs near the edge at high airspeeds. Sled tests on F-111 transparencies reduced the bird remains to the consistency of chicken soup. This should be incentive to keep the oxygen mask on if your aircraft is so equipped.

The bird-resistant transparencies will increase the chances of recovering after a birdstrike on the windshield or canopy. Engines are still vulnerable and airframe damage can be severe, so bird avoidance is still the best defense. ★



HYPOXIA

MAJOR BRIAN C. BERNET, CF
Directorate of Aerospace Safety

A review of hypoxia incidents in fighter/attack type aircraft for the period January 1970 to December 1975 reveals the following:

- A total of 40 hypoxia incidents
- Nine in which the cause of hypoxia was not discovered.
- Twenty-nine in which the oxygen flow blinker was functioning correctly but hypoxia occurred before the blinker action was seen to be abnormal.

This leads us to conclude that either the blinker, in aircraft so equipped, was either not checked or the crew did not recognize its action as an indication of an inadequate oxygen supply. Six of these incidents occurred while the pilot was flying in formation, which accounts for less frequent checking of the blinker. In only one incident was improper blinker operation observed prior to the onset of hypoxia.

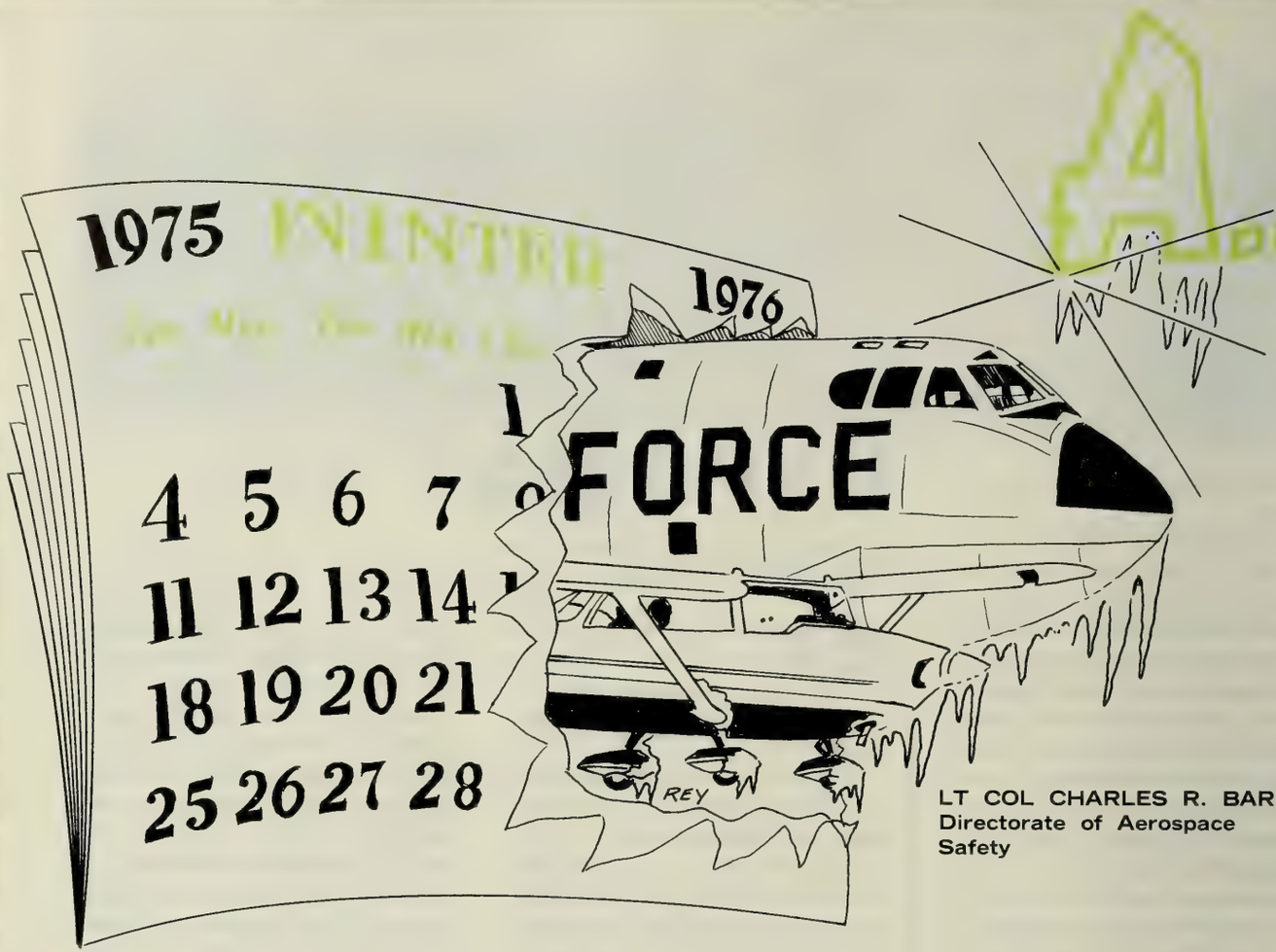
Ten of the incidents occurred while cockpit pressurization was either not operating properly or turned off and cabin altitude was higher than normal. The discovered causes of hypoxia varied from faulty oxygen masks to malfunctioning regulators and leaking lines, and many failures were insidious.

It is worthwhile to periodically remind yourself that in-flight oxygen checks are essential, they must be done conscientiously and they must include frequent blinker checks. It is not good enough to just say the words of the check. Perform each item of the check thoroughly.

Mask fit should be checked to be sure it will not permit leakage at higher than normal cabin altitude. Poor mask fit is often aggravated by turning the head and it doesn't take much of a leak to cause hypoxia. A mask leakage problem usually is not oxygen leaking out but air getting into the mask and diluting the oxygen supply.

One incident occurred in which the pilot inhaled fumes at low level. The significance of this is that after inhaling fumes for a short time, your personal smell detecting system becomes desensitized and it may appear to you that the fumes have gone away when in fact they haven't. If you have selected 100 percent oxygen because of fumes, it is a good idea to stay on 100 percent for a reasonable time, perhaps until landing.

A final word to aircrews should emphasize the importance of knowing how the oxygen flow blinker should respond to normal breathing at higher than normal cabin altitudes. At high altitudes it should be quick and responsive, not sluggish. A very small leak caused by a cracked line, loose connection or mask fit can result in a sufficient loss of oxygen to cause hypoxia. The blinker will probably still blink, but not as it should. ★



LT COL CHARLES R. BARR
Directorate of Aerospace Safety

Jet engine icing has become one of the central topics of discussion in the Flight Safety Division of the Directorate of Aerospace Safety. One could, and should, attribute this interest to a number of startling events that occurred in the recent past. Perhaps this article should have appeared in October or November 1975, but the icing season is still here, and I believe everyone should be continuously aware of the engine inlet icing phenomenon.

It is important that you recognize that all USAF jet aircraft have engine anti-ice, but not all have engine inlet anti-ice. Therefore, you must understand the type and function of the anti-ice systems on the equipment you fly. It is also important that you understand the climatological conditions where engine inlet icing is most likely to occur. Simply stated, the conditions most common to engine inlet icing occur when the free air temperature is between +5°C (41°F) and −20°C (−5°F) and visible moisture is present or the dew point is within 4°C (7°F) of the free air temperature.

Earlier, I alluded to a series of events which precipitated my interest in this article. I must say in researching the historical data, I was surprised to discover that in the time frame I chose (1972-1975) there was only one reported incident in single engine aircraft. NOTE: Historical records reviewed were those contained in the Air Force Inspection and Safety Center's computer file and pertained only to USAF aircraft statistics. Now, this implies that either our single engine jocks are smarter than our multiengine guys (an assumption which I believe is a gross exaggeration), or they are luckier, or they are flying equipment which is less susceptible to engine icing, or they plan better, or they fly in better climatological conditions, or. . . .

Regardless of the rationale you might apply in resolving this dilemma, engine inlet icing is today a more common problem in our multiengine aircraft than it is in our single engine ones. However, this indication will not stand the test of time. To illustrate, one needs only recall a winter deployment of a squadron of F-84s. In the early 1950s, this squadron departed a Texas base on a routine deployment to Indiana. Believe it or not, every aircraft in the squadron experienced engine inlet icing and crashed enroute.

This anecdote aside, what were the recent events? Well, for starters, in 1975 there were 3 aircraft destroyed and 16 lives lost. If that is not enough, how about a four-engine flameout in a B-52 or a $137,000 ice ingestion incident on

PROBLEM WITH ICE

another B-52? There is a story which goes with each one, and I hope by recounting them here they will have some impact.

The first involves a helicopter which departed on a routine mission. The first leg proceeded uneventfully; however, while the bird was preparing for the second leg, a cold front passed through his route of flight. The flight was continued in instrument meteorological conditions (IMC) in areas of high humidity and temperatures of plus 5°C and below for a period of 55 minutes. The pilot then requested a descent to 5000 feet where he reported flight in visual meteorological conditions (VMC). A short time later ground witnesses observed the helicopter making a turn, heard unusual noises and saw the blades were coning upward. Rotor RPM decreased further, and a blade departed. The nose pitched down and the aircraft continued in a vertical descent and exploded on impact. The engine(s) ingested sufficient ice to cause compressor failure and total loss of engine power.

The second and third accidents involve the loss of two attack aircraft. We lost these aircraft from the same unit within minutes of one another. The question generated was why? This is not an easy one to answer because it addresses two problems. The first was the proximity of migrating birds and the second was the danger of engine icing. No matter how you cut it, the pilots were more concerned over the possibility of a bird strike and elected to utilize engine inlet screens. Of course, the problem was that the engine screens iced over, the engines flamed out, and both aircraft were destroyed .

Fortunately, these were the only recent accidents which involved engine inlet icing, and while there were other factors involved, they will not be discussed here. However, in the case of our two B-52s, I'm going to be more specific. If you will recall, in one incident we flamed out four engines, and in the second, we ingested ice in four engines. In one or both cases the pilot may have been at fault—in the former by not maintaining sufficient engine power levels to insure adequate anti-icing, and in the latter by not obtaining a timely update of forecast weather and flying the aircraft into icing conditions that exceeded the engine inlet anti-ice capability.

I don't want to neglect our Aeroclubbers in this article. Consequently, I will include two quick stories for them. Whenever you're flying, don't forget about your carburetor heat. I recall the experience of a friend who was forced to "dead stick" a T-28 into an open field, at night, because he forgot to turn on his carburetor heat. I recall, much more clearly, my own experience which to this day affects my wife's willingness to fly with me—although she really believes I am the world's greatest and safest pilot. On this occasion, we were on leave proceeding merrily on our cross country to visit the folks in a rented Cessna 172. About 20 miles short of our next enroute stop, up jumps one of those nasty Southern Alabama squall lines. I elected to hold, in the clear, west of the line to allow destination airport to clear, when yes, we experienced a little carburetor icing. Sure, the engine ran rough for a few seconds, but nothing more serious happened. No matter, we haven't been on a flying cross country since.

The moral of these stories is that like carburetor ice in a reciprocating engine, turbine engine inlet ice often forms when not expected. One bank of clouds may not cause icing while another, which to all appearance is exactly the same, may. Remember, once inlet ice commences to form, an appreciable accumulation can build up with startling rapidity; when visible moisture is present, engine inlet icing can occur over a wide range of temperatures, above or below freezing. The increase in air velocity as air enters the aircraft engine duct, the engine compressor inlets, and the compressor inlet guide vanes cause a drop in the temperature of the entering air. Moisture in the air becomes super cooled as it passes through the engine inlet and it can cause engine inlet icing even though external ice is not being formed on the aircraft.

What I have attempted to do in the limited space of this article is to present a concern. Hopefully, that has been accomplished. However, before I retire this flowing pencil, let me reflect an opinion. The recent history of mishaps which involve engine inlet icing, presents a rather damning indictment of our pilots. There are few missions in a peacetime Air Force which are so critical that your judgment should ever be questioned. Know your equipment. Know your capabilities.



MAIL CALL

1. It is assumed that the FOD problem will continue to plague our flying activities until a new system of propulsion is devised to replace the jet engine. And, like any product, new ideas and creative salesmanship must be foremost in our approach to selling the solution.
2. I feel that "FOD" is an after-the-fact approach. We recognize dynamite as an explosive force, but we do not commonly refer to it as an "explosion" or a "hole in the ground." For this reason, and to gain a little more positive attitude towards a solution, the following article is submitted for publication:

FOD: What is it? It looks like nuts, bolts, screws, wire, rocks, and small metal parts. Simply stated, it is scraps or litter not placed in a proper waste receptical. Some states assess $500 fines for littering; however, the Air Force has no fines even though ingestion of this trash can cause a $180,000 engine loss. FOD is really a misnomer for normally it does nothing except just lie there insidiously waiting to become FOD. What we really need is a new *acronym* for all this junk, BEFORE THE FACT, like maybe, "PIU" (pick it up).

PAUL G. KREY, Colonel, USAFR
Deputy Commander for Operations
442 Tactical Airlift Wing (AFRES)
Richards-Gebaur AFB, MO

A contradiction appeared on Page 2 of Nov, 1975 issue when it states "transponders are required by law to be on all aircraft operating in controlled airspace. This is in error. . . ."

JOHN M. MILLER, Capt, USAFR
Grd Safety Officer/FAA Accident Prevention Counselor
305th Aerospace Rescue & Recovery Squadron (AFRES)
Selfridge ANG BASE, MI

In our article "Contradictions in Midair Collision Prevention?" (Nov 1975), we stated that transponders were required on all aircraft operating within controlled airspace. That was wishful thinking on our part. However, you must have a transponder with altitude *reporting:*

a. Above 12,500 feet MSL (excluding airspace at and below 2500 feet AGL).

b. Within a Group I Terminal Control Area.

Within a Group II Terminal Control Area you must have a transponder, but Mode C, altitude reporting, is not required.

Transponders are not required for IFR flights operating to or from airports located outside of but in close proximity to the TCA and transition routes pass through the TCA.—Ed.

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TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.





Captain JAMES D. THOMPSON

First Lieutenant VIC A. SORLIE

366th Tactical Fighter Wing
Mountain Home Air Force Base, Idaho

On 8 April 1975, Captain Thompson and Lieutenant Sorlie were flying an F-111F training mission at low altitude when the aircraft struck a large bird. The radome was destroyed and pieces slammed into the windscreen, shattering the right side section and pulling the glass panel loose from the frame for 14 inches. Captain Thompson immeately disengaged the auto terrain following radar, swept the wings forward, climbed to minimum enroute altitude and reduced airspeed. Because of adverse weather, he requested a rendezvous with another F-111F and made a successful return to base. After a conference between the crew, commander, director of operations and the manufacturer's experts, the decision was to fly a no flap, no slat approach to avoid the possibility of failing the windscreen. Despite limited forward visibility, Captain Thompson made an uneventful landing. Close crew coordination, professional judgment and careful analysis of the emergency enabled the crew to recover a valuable aircraft. WELL DONE! ★

Can You Identify These Men?

THESE MEN ARE:

- ☐ A. Members of a United Mineworkers local in Pasquahatchuie, KY
- ☐ B. Members of the SAC underground command post out for a smoke
- ☐ C. Waiting for their car pool
- ☐ D. Itinerant flyers making their way through China
- ☐ E. In the primary zone for the next promotion cycle
- ☐ F. Reunion of the USAF Academy Class of '42



FOR CORRECT ANSWER
TURN MAGAZINE
UPSIDE DOWN

Answer

The correct response should be D. Itinerant flyers making their way through China. These are the crew members of the famous Doolittle's Raiders after having crash landed in China following their thirty seconds over Tokyo. The story of that raid, with historic photos from the Air Force Museum, will appear in the April issue of AEROSPACE SAFETY.

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THE MISSION - - - - - - SAFELY!

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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APRIL 1976 AFRP 127-2 VOLUME 32 NUMBER 4

Wanted: Manuscripts.

Well known publisher wishes to see your unpublished manuscript. Material limited to subjects of interest to aircrews. Suggested fields include safety, aerodynamics, weapons delivery, navigation, airfield facilities affecting aircraft operations, weather, life support equipment and use, survival, tactics, and other aircrew related subjects.

Manuscripts should be double spaced. Photos and/or illustrations are desired.

Publisher will provide required author services such as rewrite, editing, punctuation and spelling. With your manuscript provide brief biographical sketch and recent photo. PAYMENT: 1. Authors of manuscripts selected for publication will receive an attractive prize.

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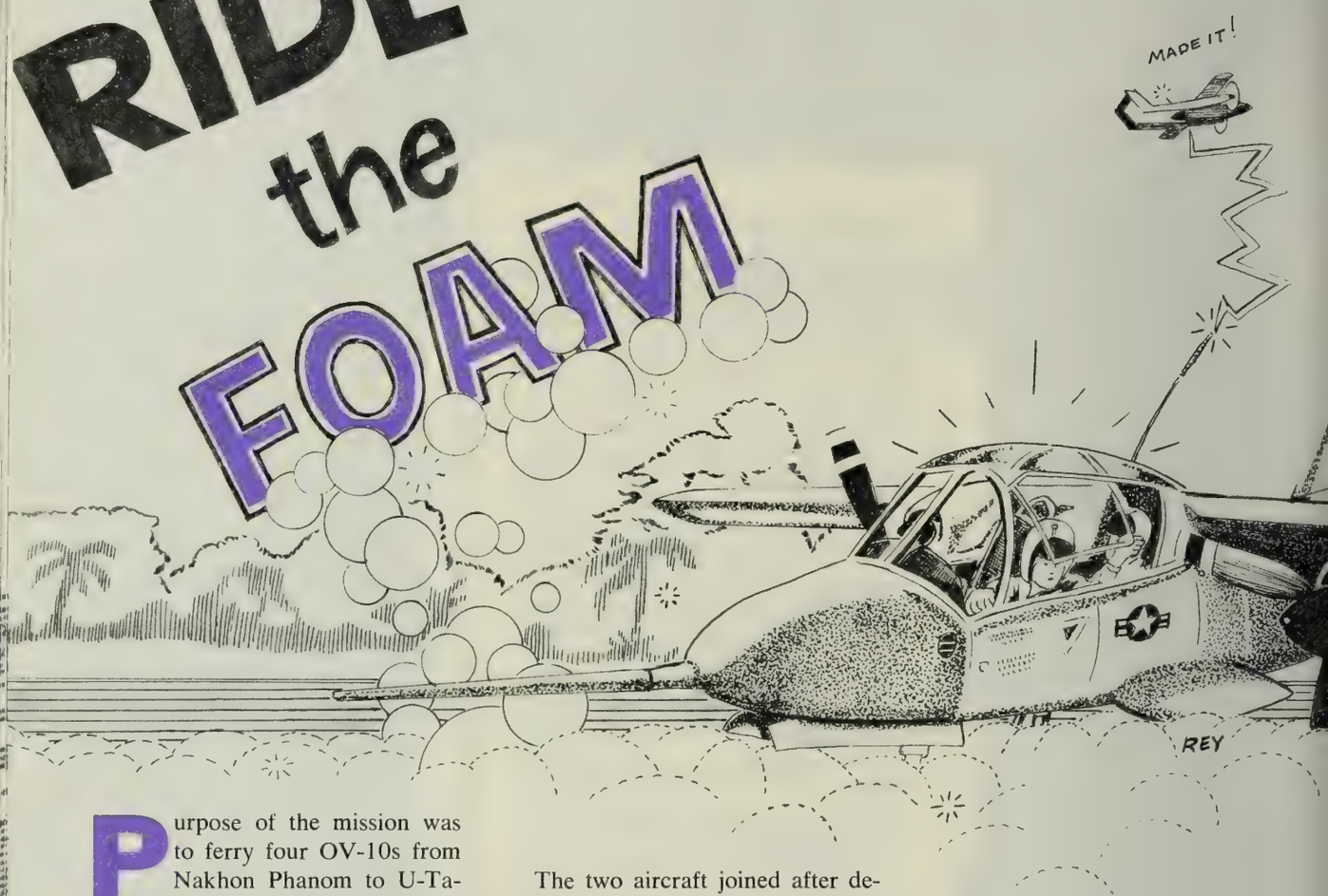
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Norton AFB CA 92409
Inquiries: AUTOVON 876-2633

All manuscripts will be acknowledged. Those not used will be returned to author.

ACT NOW! ★

RIDE the FOAM



Purpose of the mission was to ferry four OV-10s from Nakhon Phanom to U-Tapao AB, Thailand. Rustic 01 was leader of the formation. The crew consisted of the pilot and a crew chief passenger. Approach for landing at U-Tapao was VFR for an overhead traffic pattern to Runway 18, Weather throughout the afternoon was high clouds, visibility greater than seven miles and wind southerly at eight knots.

On downwind, after extension of the gear handle, the "wheels" warning light was observed and the left main landing gear indicator showed "up." The nose and right main gear indicated "down." Hydraulic power was off. Rustic 02, in trail on downwind, called that the left main gear was up. Rustic 01 retracted the landing gear and went around, requesting Rustic 02 chase him and close for a visual check.

The two aircraft joined after departing traffic to the east and climbed to 5000' MSL. Rustic 01 then lowered the gear again and the wingman confirmed the left gear doors were closed as for normal gear up flight. The right main and nose gear again extended and indicated down and locked, and again, hydraulic power was observed to be off, indicating the extension cycle was complete from the standpoint of the hydraulic system. Several attempts to get a down indication by cycling the system while porpoising and yawing the aircraft proved fruitless. To prevent overheating the hydraulic system, these attempts were spread over an approximated 30 minute period. Further attempts to get a safe indication by applying both positive and negative G were unsuccessful. There was no indication of the cause of the problem.

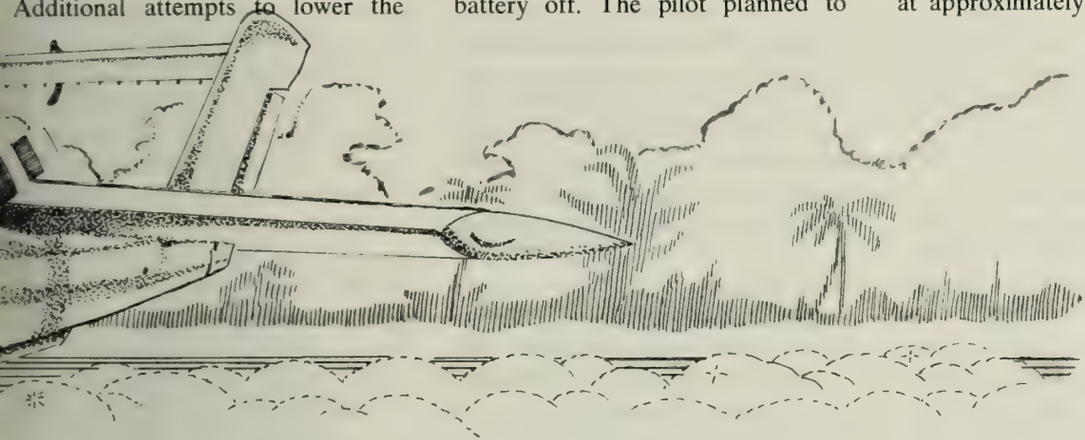
Finally Rustic 02 was forced to land because of a faulty external fuel feed system and was replaced as chase by Spad 01, leader of the second element of OV-10s. U-Tapao tower and approach control were kept advised of events throughout and Rustic 02 was directed to dispatch an OV-10 Supervisor of Flying to the control tower. Further attempts to lower the gear proved futile and all indications pointed ultimately to a gear up landing.

Spad 01 was advised to land and assist with preparations for the event.

Two additional flights of four OV-10s were inbound to U-Tapao and the tower and approach were advised that Rustic 01 would hold

until all were recovered. Additionally, Rustic 01 suggested recovering other traffic prior to the runway being closed. At this point, Rustic 01 advised he could remain airborne for an additional 1+30. Runway foaming was requested and approach control was advised that the external fuel tank would be jettisoned prior to landing.

Rustic 01 then continued to orbit, waiting for recovery of inbound aircraft to be completed and to burn fuel down to a practical minimum. Additional attempts to lower the gear were performed, but without success. Approximately 30 minutes prior to intended landing time Rustic 01 was vectored to the U-Tapao jettison area, over water, where the now empty 230 gallon centerline tank was dropped.



Rustic 01 requested status of the foaming operation and was advised of normal progress for a landing some 15 minutes later. En route from the jettison area to the pattern, a landing attitude stall was performed with engines at flat pitch to determine stall speed. Stall was indicated at approximately 72 Kts. Clearance for a low pass between the taxiway and runway was requested to provide the pilot a clear picture of the terrain on either side of the runway.

In final preparation for landing, the supervisor of flying and the pilot reviewed procedures. The passenger was rebriefed and challenged to confirm that all prelanding actions had been completed. Pattern flown was a wide left closed downwind, following the low pass down the runway. Base leg was approximately 1.5 miles from the runway and final approach was established at 85 KIAS with a glide slope approximating that normal for a GCA. At approximately one-half mile on final, pilot and passenger rechecked all loose items stowed, shoulder harnesses locked, visors down, rear seat pin installed, front seat pin convenient for quick installation, and battery off. The pilot planned to flare short in order to touch down at the beginning of the foam at approximately 75 KIAS, to insure the aircraft could be flown onto the runway rather than dropped from a stall.

The longer than normal final approach proved to be a sound decision because of the time required to establish desired 85 KIAS airspeed. The OV-10 at low gross weight without gear or external stores proved surprisingly clean, and the approach speed and glide path were stabilized at one-half mile from the runway.

The sight picture of the 18x2000 foot strip of foam proved deceptive. Over the overrun at approximately 150 feet altitude, and 3000 short of the foam, propellers were feathered. This was somewhat earlier than anticipated; but necessary to allow touchdown near the desired spot. The acceleration resulting from engine shutdown was surprisingly obvious and estimated at five knots. The final maneuvering for touchdown proved no problem; however, the pilot had to "feel" for the runway after arriving at normal touchdown and remembering there was another three feet of altitude to lose because of no landing gear. The additional five knots from propeller feathering caused touchdown to occur about 500 feet into the foam instead of at the desired point.

Touchdown was flat and smooth at approximately 75 KIAS and directional control was effective. A slight drift to the left was easily counteracted with rudder and aileron. The aircraft departed the foam slightly left of centerline at approximately 30 KIAS and decelerated rapidly with a continued slight left drift and forward pitch which could not be corrected. The front seat pin was installed as the aircraft stopped, canopies opened, and both occupants exited.

Subsequent examination revealed minimal aircraft damage confined to the sponsons and antennae for the FM radio homing, radar beacon and ALR radar warning system. The feathered propellers did not contact the runway and the nose gear doors were lightly scraped, apparently during the forward pitch as the aircraft decelerated leaving the foam. Cause of the left main gear malfunction proved to be a broken main landing gear uplock bell crank connected

FOAM continued



to the bungee which opens and closes the gear doors.

The pilot of Rustic 01 was Lt Col Edwin R. Maxson, who was awarded a WELL DONE (page 29) for his handling of this mishap. His analysis of the event and recommendations should be of interest to all pilots.

ANALYSIS AND RECOMMENDATIONS

Technical order guidance for handling the incident proved generally adequate; however, the situation and local environment required certain decisions which could have affected the outcome. First of these was the decision to jettison the 230 gallon external tank. Despite the cockpit indication that the tank was empty, some trapped fuel remains in the tank and constitutes a fire hazard. In addition to the fire hazard consideration, I also questioned the potential for directional control and lateral stability as the aircraft slowed if the landing was made on the tank. Although the wind was down the runway at eight knots at time of landing, I felt any adverse crosswind could add to the potential for side stress should the aircraft depart a straight path after touchdown. The lack of damage to the propellers and the minimal damage to the sponsons bore out the decision to jettison the tank.

Given the option of landing on the runway or the taxiway, I opted for the runway because of its greater width and a general impression that the runways and adjoining shoulders seem to be more carefully engineered than taxiways at most airfields.

The decision to have the passenger install his ejection seat safety pin was reached because of his lack of experience and familiarity with the aircraft, the seat and egress procedures. He had received formal ejection seat and egress training the day prior to the flight and I had given him a pre-flight briefing and demonstration on emergency procedures, specifically including ground egress, but this mission was his first in the OV-10. My capability to eject both of us with my system despite his seat being safed was the final criterion for that decision. The passenger's coolness and attention to instructions minimized the need for this precaution; however, I strongly recommend this procedure under such circumstances.

My pre-landing stall maneuver did not give me an accurate indication of flight conditions with both engines shut down. The flat pitch condition I chose for the maneuver created more drag than I experienced on short final following engine shut down. For the practice stall I set the torque at approximately 580 pounds, at the first indication of flat pitch. I estimated that approximately 650 pounds would have more closely simulated the engine out characteristics I ultimately experienced with the propellers feathered. Stall warning occurred during the experiment at 72 KIAS; however, I estimate the actual stall speed under engine out conditions at approximately 65-68 KIAS. Half flaps were used for both the in-flight maneuver and landing; aircraft gross weight was approximately 9100 pounds. Technical order data indicates stall will occur under these conditions at 66 KIAS.

The problem stemmed from an incorrect power setting for engine out simulation in the practice stall. The lower than anticipated stall speed plus the estimated five knots gained by feathering the propellers resulted in touchdown approximately 400 feet longer than intended. Under similar conditions I recommend the practice stall be accomplished and results cross checked against the technical order. Recommend touchdown be planned for 5-8 knots above indicated stall.

Foaming for this incident consisted of one strip 18x2000 feet beginning 2000 feet down the runway. After touchdown at 75 KIAS, approximately 50 feet into the foam, the aircraft decelerated slowly and departed the foam at the far end at approximately 30-35 KIAS. An additional 2000 feet of foam would probably have permitted the aircraft to come to a stop before going onto the dry runway. Recommend 4000 feet of foam be considered, circumstances permitting.

During the time I was awaiting recovery of inbound aircraft the 56 SOW/DO contacted the 19 TASS in Korea and the chief OV-10 pilot at Rockwell Corporation in Columbus, Ohio. Both agencies concurred with the analysis of the problem and the decision to execute a gear-up landing. When feasible, recommend taking advantage of the OV-10 capability for holding to allow supervisors time to contact other units and agencies for technical assistance and advice ★

1975 USAF SAFETY TROPHIES



Secretary of the Air Force Safety Trophy

AIR TRAINING COMMAND

ATC had the lowest aircraft accident rate, the fewest aircraft destroyed, and the fewest aircraft accident fatalities in the 29-year history of the command. ATC was also significantly lower than the Air Force average in every category of ground accident prevention evaluated.

ALASKAN AIR COMMAND

The Alaskan Air Command did not experience a single major or minor aircraft accident for the first time in 5 years. Also, the command did not experience any explosives or missile accidents, and ground accidents were reduced in every category.



Maj Gen Benjamin D. Foulois Memorial Award

AIR TRAINING COMMAND

ATC's aircraft accident prevention accomplishments were judged to be the most effective of all major commands. The command flew more than half a million sorties involving intensive student flight training events in a high density traffic environment. The award will be presented at the Naval Air Station, Pensacola, Florida, during the Annual Awards Dinner of the Order of Daedalions, 15 May 1976.

THE RISE OF THE EJECTION SURVIVAL RATE

MR. RUDOLPH C. DELGADO
Directorate of Aerospace Safety



On 29 August 1949, a young lieutenant, flying an F-86 aircraft out of a Southern California Air Force base, ejected when the aircraft lost aileron boost and went out of control when one wing tip tank would not jettison. He had to manually open his lap belt, kick away from the seat, and pull the parachute ripcord (that is how it was done in those days). Even though he lost his helmet, and the seat hung up in the risers, rode down with him, and hit him on the head during PLF on a rough mountain top, the ejection was otherwise uneventful and he survived.

He probably did not know it at the time, but the lieutenant was making Air Force history. He was the first USAF crewman to use an ejection seat to escape from a disabled aircraft.

During the intervening years, from that momentous day in 1949 through 31 December 1975, 4,265 other crewmen flying noncombat missions found it necessary to eject from their aircraft. Of these, 3,518 survived. This makes the ejection survival rate for those 27 years 82%.

There was one other ejection in 1949 and it, too, was successful, so that year's survival rate was 100%. That was never to be repeated. From then on, as the number of ejections increased, the survival rate decreased. It hovered between 89% in 1959 (262 survivors out of 296 attempts) and 74% in 1972 (91 survivors out of 123 attempts). In 1975, however, a significant improvement was recorded. There were 79 ejections and 72 crewmen survived for a remarkable 91%. What makes the 1975 survival rate even more significant is the fact that this record was achieved with virtually the same ejection systems that were in use in 1972 when the lowest rate was attained.

Between 1972 and 1975 there were no major improvements made to ejection systems that could be credited with improving the survival rate. Who then, or what, rates the credit for 1975's high survival rate? The aircrews themselves, that's who. They did this simply by making their decision to eject



Ejection systems such as the Martin Baker H7 in the F-4, shown on page 6 and during inspection, below, are reliable and will save lives when used within their operational envelope. Initiation outside the envelope accounts for most ejection fatalities.



and executing it while they were still within the safe escape envelope of their ejection system. This indicates a high degree of knowledge and understanding on the part of the crewmen involved concerning the capabilities and limitations of their particular ejection system. Armed with this knowledge and understanding, they were in a position to make the decision to eject at the proper time and thus save their lives.

Crewmen who know their ejection system's limitations can save their lives even when flying in older aircraft with a less sophisticated ejection system. This was also proven in 1959 when the next highest survival rate was recorded. Ejection systems in those days had a lot less capability than do present day systems—zero/zero was unheard of.

Nowadays there is talk about super sophisticated ejection systems, such as the high technology ejection seat, that can allegedly recover an ejectee from such conditions as zero to 50,000 feet altitude and zero to 600 knots airspeed plus varying conditions of inverted flight and high sink rates. This is all very good and these systems will be welcomed, but the reality of the matter is that none of these are flying right now and it might be at least two years before a limited quantity will fly. These may someday be used in some of the newer weapon systems such as the A-10, B-1, F-15, and F-16.

In the meantime, the systems that have been around, in some cases since the 50's, will have to do. And, they will do if used within their design limits. No matter how primitive the system, if it is used within its defined safe-escape envelope, it can save a crewman just as well as a modern one.

Historically, the primary cause of ejection fatalities has been initiation outside the safe-escape envelope. This was also true for 1975. Six of the seven fatalities were attributed to this. Many times accident boards are not able to determine what conditions were present to cause crewmen to delay their ejection until it was too late. In some cases, though there has been evidence to suggest there was an opportunity for safe escape, the initiation was delayed until this opportunity had passed. In these cases, it can only be speculated that crewmen might have overestimated their ejection system capability. They might have thought they could try to cope with the aircraft problem a little longer, assuming they could eject at the last second and survive. They were tragically wrong.

The best insurance a crewman can have for surviving an ejection is to be armed with knowledge of the capabilities and limitations of his particular ejection system. He then must use this knowledge to make the decision to eject at the proper time, when his aircraft is no longer of use to him. ★



The following is quoted from a commercial jet accident investigation report:

"The aircraft stalled at 24,800 feet MSL and entered an uncontrolled spiralling descent into the ground. Throughout the stall and descent, the flight crew did not recognize the actual condition of the aircraft and did not take the correct measures necessary to return the aircraft to level flight. Near 3,500 feet MSL, a large portion of the left horizontal stabilizer separated from the aircraft, which made control of the aircraft impossible.

"The National Transportation Safety Board determines that the probable cause of this accident was the loss of control of the aircraft because the flight crew failed to recognize and correct the aircraft's high-angle-of-attack, low-speed stall and its descending spiral. The stall was precipitated by the flight crew's improper reaction to erroneous airspeed and Mach indications which had

ATTITUDE

LT COL ROBERT J. BRUN
Directorate of Aerospace Safety

resulted from a blockage of the pitot heads by atmospheric icing. Contrary to standard operational procedures, the flight crew had not activated the pitot head heaters."

The three crew members, who were the only persons on board, died in the crash and the aircraft was destroyed. When we reflect on the experience level of the average commercial crew, the 12-minute duration of this flight, and the relative magnitude of their initial error, we might begin to wonder how such a simple problem was allowed to slowly develop into an in-flight loss of control.

The answer, in a few words, is that attitude instrument flying was abandoned for all practical purposes, despite several verbal exchanges between the crew relating to the unbelievably high readings on the pitot-static instruments. For instance, as the aircraft passed 16,000 feet enroute to FL 310, the copilot, who was at the controls, remarked that they were doing 340 knots and climbing 5000 feet a minute. As the climb progressed, recorded data showed an increase in both airspeed and rate of climb which eventually exceeded 6500 fpm prior to the stall.

The crew made two radio transmissions during the descent. The first was a mayday stating "we're out of control descending through 20,000 feet"; and 39 seconds later, "we're descending through 12, we're in a stall." Total time for the descent was 83 seconds and the peak recorded rate was 15,000 feet per minute.

Results of the investigation indicate the recently upgraded copilot responded in reverse on two consecutive pretakeoff checklist items, and the error here is an object lesson for all cockpit crew members. Switch location and crew habit patterns sometimes lead to a checklist callout procedure wherein two or more consecutive items are called before pausing for a response. In this particular case, it appears that the flight engineer normally stated, "Ice protection (engine anti-ice), pitot heat" before pausing for the responses. All available evidence indicates the copilot responded with "Off, On" but actually turned on the engine anti-ice and left the pitot heat off.

As a result of this error, the pitot pressure inlets for the three independent systems were blocked by ice at approximately 16,000 feet resulting in a constant pitot pressure from that point onward in the flight. The stick shaker, which is activated by angle of attack instrumentation, was initially set off at a calculated airspeed of 165 knots as compared to the 412 KIAS shown on recorded data. Although the crew had reason to attribute some part of the abnormal aircraft performance indications to light gross weight, winter weather conditions and the possibility of strong up drafts, the aircraft attitude should have warned them of the approaching stall.

During the last few seconds of controlled flight, there was an almost simultaneous activation of the stall and overspeed warnings, but the copilot apparently continued to react to the airspeed indicators and their associated warning systems. Both pilots misinterpreted the final stick shaker control vibration. The copilot stated "there's that Mach buffet," and the captain commanded "pull it up." A combination of calculated and flight recorder data indicate the pitch attitude would have been about 30 degrees nose up as stick shaker speed was approached, whereas a plus 5 degrees is normal for climb.

All of us can think of many routine aircrew actions which should have stopped this accident sequence before takeoff or early in the climb. However, the real thought paralyzer in this review is why was the last clear chance for survival never taken? Basic attitude flying would have saved the day even after the stall occurred, and the failure to correlate attitude and performance indications long before that point is a question that will never be fully explained.

Looking back over the entire experience, there are some additional lessons in aircrew attitude as well. It proves once again that flying is a business which requires a challenging attitude and that our success or failure as flyers may well be determined by how often we exercise that prerogative. ★

THE IFC APPROACH

Most of this month's article deals with questions the IFC receives about low altitude approach procedures.

Q: What is a procedural track and how is it depicted?

A: A procedural track is a maneuver that is used in place of a procedure turn, or a holding pattern in lieu of a procedure turn. It is designed to align the aircraft on the inbound course to the final approach fix (FAF), at FAF altitude in the final approach configuration. The procedural track is depicted by a heavy blue line showing the intended aircraft ground track and may employ an arc, course, dead reckoning (DR) leg, teardrop, or any combination of these.

Figure 1 is an example of an arc to radial approach. Pilots are expected to lead the turns, both onto the arc and onto the final approach course.

Figure 2 depicts a DR leg that intercepts the final approach course. As you can see, the 130 degree leg has no course guidance. Apply any known wind to the DR leg heading so as to make good the ground track of 130 degrees.

Figure 3 shows a teardrop procedural track. Since the 120 degree outbound course is a desired ground track, use the course intercept immediately after station passage procedures outlined in AFM 51-37 to intercept the course.

Q: When may I depart my last assigned altitude when cleared for the approach in Figure 3?

A: AFM 51-37 says, "Start the descent to the turn altitude when the aircraft is established on the procedural track course." However, if excessive maneuvering is required to capture the outbound course, the approach may become difficult or impossible to fly. Consider an aircraft that is approaching the Alexandria VOR from the south, at an assigned altitude of 3000 feet. Application of the above rule would prevent descent to 1700 feet until established on the 120 degree radial outbound. An unknown wind could possibly prevent course interception prior to turning back inbound. In this situation, use high altitude penetration procedures, i.e., when a descent is depicted at the IAF, start descent abeam the IAF after you have established a parallel or intercept heading to the procedural track course. The reason you can use this procedure is because AFM 55-9, United States Standard For Terminal Instrument Procedures (TERPS), directs approach designers to allow the same protected airspace around both high and low altitude IAFs.

FIG. 1

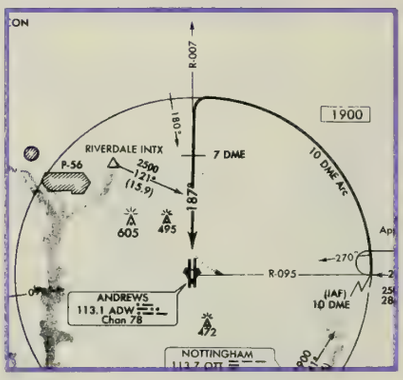


FIG. 2

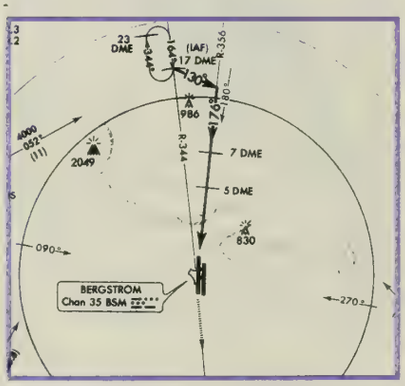
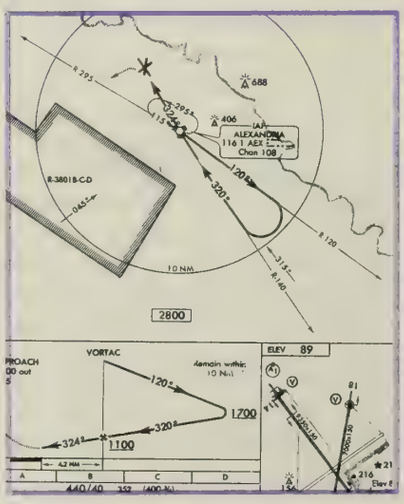


FIG. 3



The revised AFM 51-37 will not require an aircraft to be on course for a descent that starts at the IAF.

Q: When may I turn inbound on a teardrop procedural track like the one in Figure 3?

A: When a specific turn fix is not depicted, you may turn inbound at any time as long as you do not ex-

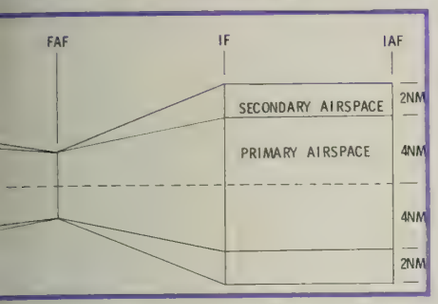


FIG. 4

ceed the published "remain within" distance. The point where you initiate the turn inbound should depend upon aircraft turn performance, winds, and the amount of descent required on the inbound course. Ensure that you fly outbound far enough to allow sufficient time to capture the inbound course, descend to the FAF altitude and establish approach configuration.

Q: AFM 51-37 and most flight manuals tell me to configure prior to FAF. If no final approach fix is depicted on an approach, when should I perform my landing configuration?

A: Approaches without FAF's exist in both high and low altitude instrument approach procedures. They are used when the approach is designed off a VOR or NDB which is located on the airfield. In most cases, a FAF would be either impossible or impractical to define.

In the low altitude structure, these procedures normally incorporate a procedure turn. Figure 5 is an example. The final, in this case, begins at the point where you intersect the final approach course inbound. When you are on course inbound, you are on final approach. A point to think about on approaches like this, is that you can reach the missed approach point more quickly than you think. Prior planning is necessary to ensure that you reach MDA and configure to land as soon as possible. Consider lowering the gear and flaps, if applicable, prior to the turn inbound.

In the high altitude structure, (see Figure 6), a procedure with no FAF incorporates a penetration turn. Here, the final approach begins on the inbound course 10 miles from the navigation facility. If normal descent rates are used to depicted turn altitudes, an aircraft will fly outbound far enough to allow sufficient time to configure after completing the penetration turn and prior to reaching the final approach segment. Fuel considerations and directives that govern your operation may dictate whether you perform your landing configuration outbound or inbound. In lieu of specific directives, either is acceptable. ★

FIG. 5

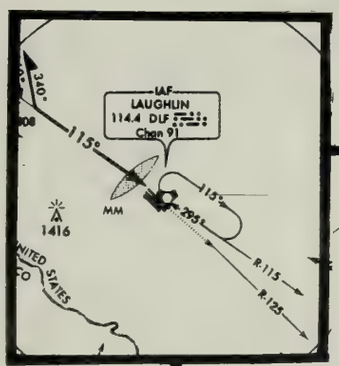
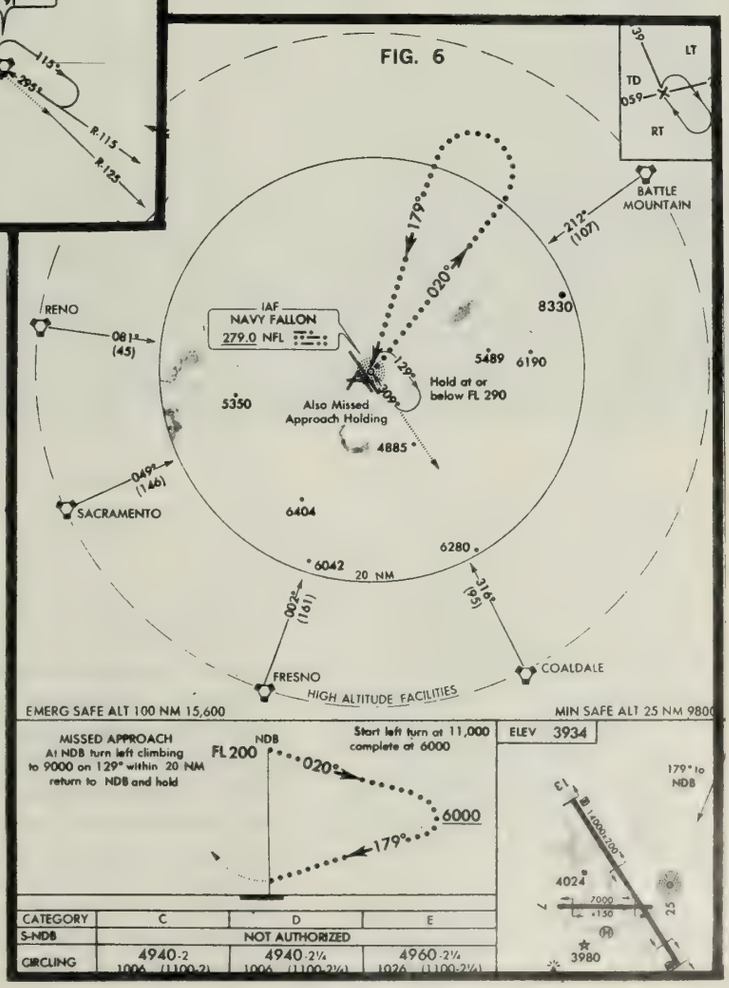


FIG. 6



WHEN IT RAINS

CAPTAIN GUY P. SUMPTER
54 FTS
Reese AFB TX

"Any questions, sir?"

"No ice?" I asked.

"No sir. None forecast and none reported so far," the duty forecaster answered.

"O.K. Thank you much," I said, reassured that on this leg of our cross-country, the T-38A trainer we were flying would not suddenly find herself in a compromising situation with Old Man Ice. Ice and the Talon mix (as all '38 drivers are frequently reminded) about as well as oil and water!

Let's see, I recounted to myself. A ragged ceiling at 2500 ft, layered up to about 14,000 ft, rainshowers in the vicinity, but no thunderstorms reported along our intended route. Not exactly "clear and a million," but not bad for a mid-June, early-morning departure from Tyndall.

My student, 2Lt Dodd, and I timed our preflight and engine start so as to avoid taking an unplanned shower; then we taxied out to the active runway. After being cleared for takeoff, and after a careful check of the navigation equipment, we began our takeoff roll. Gear's up. Everything's going smoothly, I thought, as I paid close attention to my student's performance. Wait a minute! What's wrong here?!

I had just begun to transition to the gauges when I noticed that the main and standby ADIs each indicated approximately sixty degrees of bank—in opposite directions!

In a flurry of intercockpit communication, the student confirmed that his ADI indications were identical to mine. By this time we were entering the overcast. Even though I quickly considered ducking back under the clouds, it was too late—we were in solid IMC.

With the VVI indicating a 3000 fpm climb, and a constant airspeed of 300 knots, I elected to continue the climb, hopefully to one of the spaces between cloud decks, that the Tyndall forecaster had "promised" us earlier. Talk of needle, ball and airspeed flying had always been cheap, but now I was going to get to try my hand at it.

Only a matter of seconds after first noticing and confirming the erroneous ADI indications, I uttered the most common of all UPT phrases, "I've got the aircraft!"

"Roger, you have the aircraft," was the response from Lt Dodd.

Informing Departure Control of our emergency situation, I requested and immediately received clearance to continue the climb straight ahead, out over the Gulf of Mexico. At approximately 8500 ft MSL, we broke out between layers and leveled off. "Remind me to buy that weatherman a beer when we get back on the ground," I joked nervously to myself.

Just then, as if it had been patiently awaiting its turn to fail, the HSI began to spin.

"Request no-gyro vectors away from any known weather," I snapped to Departure Control.

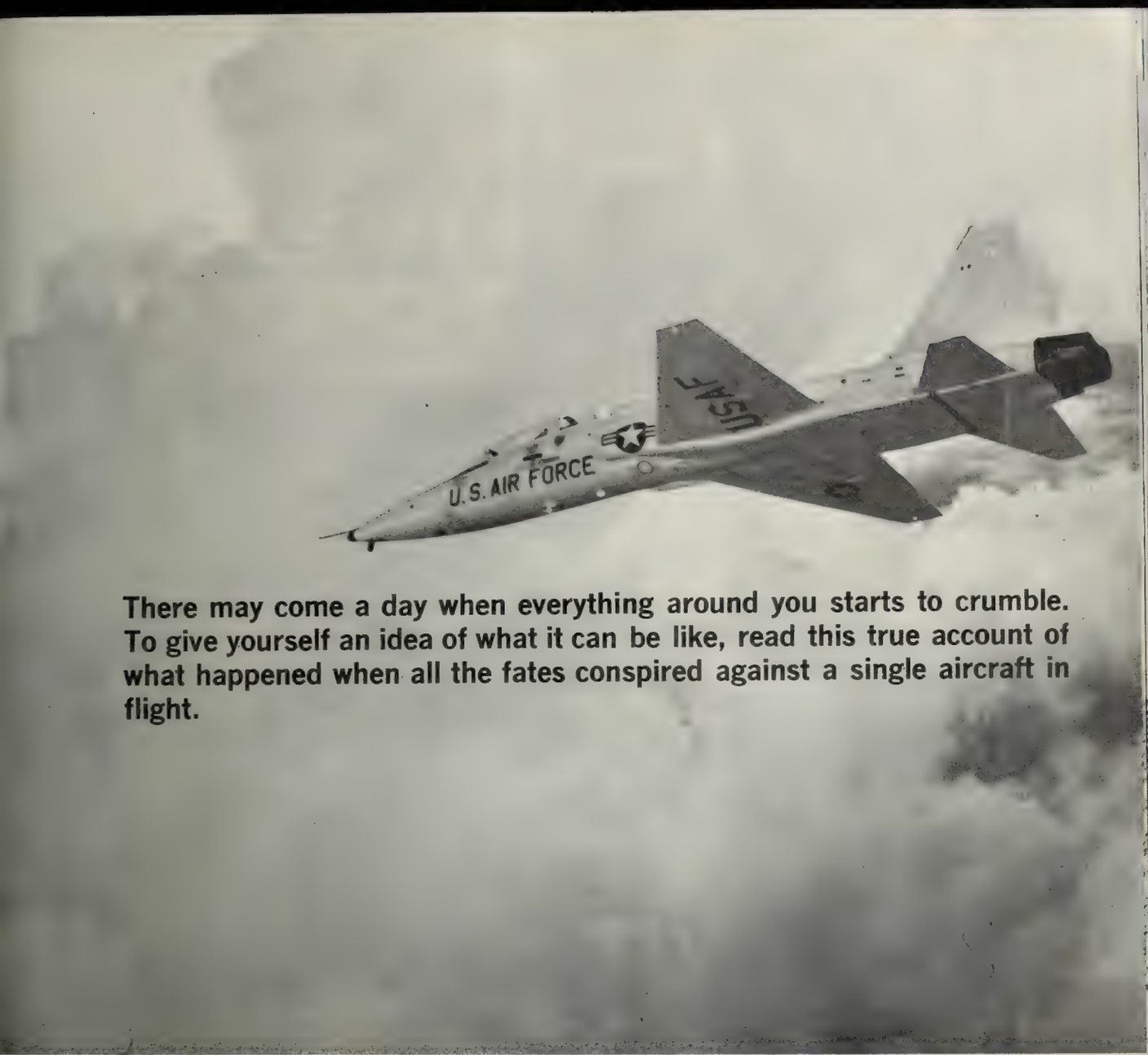
"Turn. . . ." Pause. "Stop turn," was the controller's response.

This, however, proved to be our last outside radio contact of the mission. Our UHF radio had suddenly decided to jump on the equipment failure bandwagon, which was, by this time, getting as crowded as we cared to see it!

After flying the heading we had received for a short, yet seemingly long, time, we spotted the blue-green of the ocean below and began a spiralling descent down through the hole in the undercast. Once we were safely below the clouds (about 1500 ft MSL), I picked up a heading on the mag compass that I knew would get us back over land. The DME from Tyndall read 30 NM at the time. 15 NM later we were over the Florida coast.

An attempt to fast-slave the HSI proved successful, so I then tuned the Tyndall ILS and turned to an intercept heading for the localizer course.

As we drew closer, it was apparent that the rainshower we had so cleverly avoided prior to takeoff was now over the field. Nevertheless, I elected to attempt



There may come a day when everything around you starts to crumble. To give yourself an idea of what it can be like, read this true account of what happened when all the fates conspired against a single aircraft in flight.

the landing, rather than risk further equipment failure.

Flying the ILS while trying to retain visual contact with the ground, we finally spotted the runway approximately a mile and half out. Our "white rocket" touched down very close to the approach end; however, this was where all similarity to a normal landing ceased. The heavy-weight bird began to hydroplane and weathervane in what turned out to be 15 knots of crosswind blowing across a two-inch thick sheath of water standing on the runway. 8000 ft of runway later we had finally slowed sufficiently to turn off. As we did so, the right main tire, exhausted from the ordeal, flattened itself against the concrete.

A few seconds of mutual silence, and then two heavy sighs of relief. Time to close our flight plan.

Captain Guy P. Sumpter graduated from UPT at Moody AFB, Georgia in Class 69-03. He went directly to Vietnam to fly the U-10 there and eventually in Korea. He accumulated over 600 combat hours in the U-10. Captain Sumpter then went to Travis AFB to fly the C-141. He flew the C-141 for two and one-half years and became an Flt Examiner in it. He moved from there to Reese AFB and the T-38 where he is now an instructor pilot in the T-38 and a flight commander. He has accumulated over 3000 hours of total flying time. Captain Sumpter has amassed over 1000 hours of instructor time in the T-38. ★

FROM WHENCE WE CAME

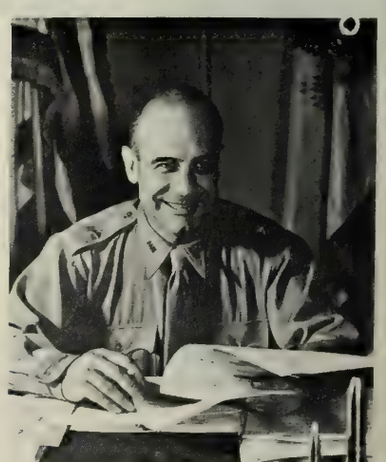
B-25s OVER TOKYO

18 APRIL 1942

MSGT DAVE SYLVA
63 MAW Norton AFB CA



B-25 bombers on deck of the Hornet enroute to launch area. They had flown from Eglin Field, FL, where crews practiced very short takeoffs, to McClellan Field near Sacramento, CA, and loaded aboard at Alameda NAS on San Francisco Bay.



"Tell Jimmy to get on his horse," was the message to Lt Col Jimmy Doolittle (shown here in later photo as a brigadier general). Cryptic message meant the mission was "on."

On December 7, 1941, carrier borne planes of the Imperial Japanese Navy broke the back of the US Pacific Fleet. In every corner of the world the Axis powers were smashing their way through Allied defenses. Distance and censors kept the awful truth from the American people, but no matter how they tried to soften the blow, there was no escaping reality. Guam had fallen, the Japanese had sunk *H.M.S. Prince* of Wales and *Repulse* and were driving the British down the Malay Peninsula. On December 22, the tiny garrison on Wake would be overwhelmed. On Christmas Day, Hong Kong would surrender. The American Army in the Philippines, stripped of air power, was retreating into Bataan on Luzon. The situation was desperate.

Damage control parties were still fighting to free trapped sailors and to save what was left of the Pacific Fleet as the meeting got under way. President Roosevelt told his staff he wanted "a bombing raid on Japan as soon as humanly possible." The raid would be for psychological effect only. It would boost the morale of the American people and our Allies. It would give the Japanese an emotional setback. It did that and more. It altered the course of World War II.

A plan to bomb Japan from Chinese bases was drawn up. Twelve B-24s under Col Harry Halverson flew east across the Atlantic to Africa. Before they could fly to New Delhi and on to China, they were diverted to Egypt to fly the first Ploesti oil field mission.

The next best hope was a carrier strike. Unfortunately, the short range of the Navy planes would put the strike force and the too valuable carriers within the attack radius of Japanese land-based bombers.

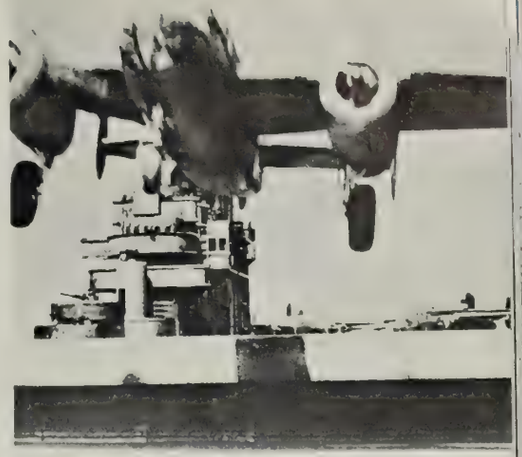
Having been a bastard son of the Army for so many years, the Air Force had learned to improvise. Both Army and Navy flyers had spent their lives and given their lives overcoming "fundamentalist" thinking. Nothing was impossible. Some problems just took a little longer to solve. This problem would also be solved.

On January 4, 1942, at another meeting, the Chief of Naval Operations, Admiral Ernest J. King, was discussing plans for the invasion of North Africa. He offered a suggestion that Army bombers be transported on one of the three carriers to be used. The seed was planted. General "Hap" Arnold, Chief of the Army Air Force, taking notes wrote: "We will have to try bomber takeoffs from carriers. It has never been done before but we must try it out and check on how long it takes."

A Navy officer, Captain Francis S. Low offered a suggestion to Admiral King that Army medium bombers be launched from a carrier for a strike against Japan. He had watched Navy pilots at Norfolk, VA practicing short takeoffs from a simulated carrier deck painted on the runway there. Later, he had seen Army twin engined bombers making simulated bombing runs over the same runway. The two perceptions meshed into the germ of an "impossible" idea.

The idea was examined by Admiral King's staff and the plan began to take shape. The brand new carrier, *Hornet*, could take 16 North American B-25 *Billy Mitchell* medium bombers on her flight deck. Steaming at better than 25 knots and escorted by a screening force, the Hornet would take the bombers to within 500 miles of Japan. After launching the bombers, the Hornet would do a one eighty and head for home. The bombers would strike their targets and fly on to Chinese fields. It would work, if, and it was a big if, Army pilots could get a bomber off a carrier deck. There was only one way to find out.

Arnold called an old and trusted friend, Lt Col James H. Doolittle, to oversee the project. Doolittle had just finished working the jinx off Martin's B-26 *Marauder*. Now he was told to see what it would take to get a medium bomber off the ground in 500 feet carrying a 2,000



B-25s took off in a squall that lashed the task force. All 16 made successful takeoffs in exactly one hour.



Raider flying over Yokosuka navy base. Hub of propeller on right engine can be seen at lower right.

We wish to gratefully acknowledge the Air Force Museum at Wright-Patterson AFB, Ohio, for providing the photographs accompanying this article.



Doolittle sits beside wing of his aircraft. All of the raider aircraft either crash landed, ditched in the sea or were abandoned.



Lt Robert Hite blindfolded and being led away to capture. He spent 40 months in Japanese prison camp and returned home when Japan surrendered.

pound bombload and enough gas to fly two thousand miles. The answer was typical of Doolittle; "I'll need a little time on that one. Give me a day or two." He had the answer the next day. The B-25 could do it if the crews were properly trained and if the plane was given extra tanks. Doolittle got that job too.

Twenty-four *Mitchell's* were modified to include the required extra fuel tanks. Twenty-four crews were assembled out of the 17th Bomb Group and the associated 89th Reccy Squadron. The men were volunteers who had been told only that they were needed for an extremely hazardous mission that would require the greatest skill. Of this "First Special Aviation Project" only Doolittle and his deputy, Major John A. Hilger knew that it involved a carrier takeoff.

The selected crews reported to Eglin Field, Florida at the end of February. A flight instructor from Pensacola NAS, Lt Henry L. Miller was given the job of training the Army crews in very short field takeoffs. He found that the crews were sharp and that they learned quickly.

While training progressed, the armaments officer, Capt Ross Greening, dummied 50 calibre broomsticks to give the B-25's the illusion of protection in the tail. He also fashioned a 20¢ bombsight that was more accurate at low altitude than the highly secret Norden bombsight.

On March 21, a message was flashed to Eglin: "TELL JIMMY TO GET ON HIS HORSE!" The mission was on. Doolittle assembled his 22 remaining crews and told them that they were leaving. They took off from Eglin and flew to McClellan Field near Sacramento, California.

From McClelland, the planes flew to Alameda NAS where 16 of them were hoisted aboard the *USS Hornet*. The larger planes took every inch of available deck space. The crews were mixed in with the Navy people wherever berths were to be found.

April 2, 1942, the *Hornet* weighed anchor and headed west. Her escort included the carrier *Enterprise* out of Pearl and fourteen other warships.

While the convoy zigzagged its westerly course, the war went on. April 9, the exhausted garrison on Bataan had surrendered. The sick and wounded defenders set out on a death march to prison camps.

As the days dragged by, the crews performed maintenance on their planes and had their pockets picked by Navy card players. The Navy crew had been told the destination of the *Hornet* the same day they left San Francisco Bay. Morale was high and both Army and Navy men, friendly enemies, forgot all previous rivalry. Harmony was the order of the day.

The raid was to be launched after the *Hornet* had put the planes within 400 miles of Japan. From this distance, Doolittle hoped to be over Tokyo at Sunset on April 19.

Three a.m. on the 18th, patrols from the *Enterprise* spotted Japanese surface vessels. An alarm was sounded, but the task force turned to a new heading and avoided detection. At 6:00 a.m. another Japanese ship was sighted, this time from the *Hornet* herself. At almost the same time, *Hornet's* radioman intercepted Japanese radio traffic from somewhere close to the carrier. The element of surprise was gone. The task force had been seen and the patrol vessel, before she went under to the *Nashville's* guns, had flashed a warning message to Japan.

Only one choice could be made. At 0800 hours the *Hornet's* loudspeakers blared "ARMY PILOTS, MAN YOUR PLANES!" The task force was 630 miles east of Japan. An early launch would put Doolittle's raiders over the targets in broad daylight. There was nothing else to



Unidentified American flyers shown with Chinese who befriended them.



President Roosevelt presents Doolittle with Medal of Honor. Others in photo, General Henry (Hap) Arnold, Mrs. Doolittle and Gen George C. Marshall.

do. Each moment the takeoffs were delayed put the task force in danger of attack by Japanese land based bombers.

At 0820, April 18, 1942, Doolittle's plane released brakes and lumbered down the flight deck into the teeth of the squall that lashed the task force. Five minutes later, the second aircraft lifted from the *Hornet's* deck. Exactly one hour after Doolittle's takeoff, the sixteenth plane flown by Lt Bill Farrow was airborne.

The Navy's job done, the task force turned 180 degrees and retired at flank speed. The Raiders pressed on to the heart of the Japanese Empire. They had no idea of what waited ahead for them. The enemy had been warned. The targets, Tokyo, Yokohama, Nagoya, Osaka and Kobe, would be swarming with fighters—if the bombers got that far. The added distance and weather would alter their plan to land at friendly fields in China. There was no way alternate plans could be worked out now.

The Mitchells, each loaded with two 500 pound bombs and 1,000 pounds of incendiaries, raced for their assigned targets. Some of the raiders would encounter enemy fighters, some would catch flak. Some would, much to their surprise, find that the Japanese mistook them for their own and waved to them as they flashed over their heads.

All of the planes unloaded their bombs. They did what they had set out to do. Even if only in token measure, Pearl Harbor was avenged. The agony that had tormented the American people as we suffered defeat after defeat was somehow less stinging.

None of Doolittle's planes would be saved, though. They would crash land in China or ditch in the Yellow Sea. Crews would bail out and hope they landed among friends. One plane landed in Siberia. It was confiscated. The crew was interned and put to work by the Russians. They escaped and made their way home more than a year later.

Most of the Raiders made it home but not all. Three of them, SSgt William J. Dieter, Corporal Leland Faktor and Sgt Donald Fitzmaurice died in the crashes of their planes. Eight raiders fell into Japanese hands and suffered the hell of torture and captivity for three years. 1/Lt Bob Meder was allowed to die in prison of beri beri. Three prisoners of war, 1/Lts Bill Farrow, Dean Hallmark and Sgt Harry Spatz were executed by their captors in October 1942. They gave all they had to give.

Yes, they did what they set out to do and in doing it the eighty raiders of Doolittle's "Special Project" changed the course of the war more than they realized.

Admiral Isoroku Yamamoto, the man who had planned the Pearl Harbor raid, was responsible for the defense of the Emperor and the home islands. The success of the Doolittle strike proved that the Americans still had teeth. Yamamoto suspected that the raid had come from an aircraft carrier. The carriers had escaped destruction at Pearl Harbor and were still ranging in the Pacific. He devised a plan to bring the enemy to battle on his terms. The fight he picked cost him his carrier force instead and ended Japanese offensive plans in the Pacific. It was called the Battle of Midway.

One year to the day after the Doolittle raid, on April 18, 1943, US Army Air Force fighters intercepted and ambushed Admiral Yamamoto's plane over Bougainville. The man who started the chain of events on December 7, 1941—the man whose embarrassment and frustration had brought about the destruction of his Fleet at Midway died in the flaming wreckage of his plane. ★



NIGHT FLIGHT

A couple of years ago, when I was a T-38 instructor pilot at Laredo AFB, Texas, I instructed civilians, during my off duty time, for a company based at Laredo International Airport. One day I had to make a flight to Corpus Christi, which is on the coast about 150 miles southeast of Laredo. Since it was a sunny spring day, I invited a friend to accompany me on this flight, a lieutenant named Lisa. She had never flown in a small single-engine plane before, her total flying experience having been just one flight in a commercial jet.

After taking care of my business, we did a little shopping and had a nice dinner at an oceanside restaurant. We planned an 8:30 p.m. departure for a night time ride back to Laredo.

An hour later we were cruising at 4500 feet about 25 miles from Laredo. It was a beautiful night, very clear, but no moon! Flying over Southwest Texas on a clear, dark night is an unusual experience. One gets the illusion that you are

CAPT RICHARD P. KEIDA, 772 TAS Dyess AFB TX

flying over the ocean with small, brightly lit islands scattered here and there. In reality, the islands are small towns separated by vast, unlit areas of desert and ranch land.

I was sitting in the right seat, and Lisa was actually flying the Cessna 150 from the left seat. She was doing an excellent job, so I was relaxing and enjoying the ride. Suddenly I felt a light vibration in the seat and soon the entire airframe began to vibrate!

I took control of the aircraft and then—wham!! The only propeller departed the airplane, and the engine started reving up now that the load of the propeller wasn't on it anymore.

I shut it down and quickly ran through my emergency procedures and set up a glide, knowing that a forced landing into that dark area below us was inevitable. I explained to Lisa that we had a problem—but since we were still "flying" she was not at all upset! She thought that we were just going to coast up to the runway—still 20 miles in front of us!

I radioed approach control at Laredo and declared an emergency, explaining that I was going to attempt a forced landing, and requested assistance after we had completed our landing. With this taken care of, I concentrated on setting up my landing pattern.

Since it was so dark, I decided the landing light would be helpful. Unfortunately, when the prop broke away, it hit the cowling just below it. The landing light *was* in that cowling—but no more! Now we were in real trouble! Below us was some rough terrain and mesquite trees, all hidden in the "black" darkness. Desperately looking for some ground reference points to facilitate the landing, I kept rolling the aircraft into some shallow turns to see what was below us.

Unknown to me at the time, there was a resident of Laredo, along with his wife, parked on the highway just under us. They had just decided to return to Laredo—and on came their headlights as they started down the road. Lisa saw this car and calmly mentioned it to me. As I looked at the stretch of pavement in front of the car, I decided to use that highway as a runway! My plan was to spiral down over the car and when I was low enough, just glide over the top of his car and land in front of him on the well lit road!!

I still had a battery operated rotating beacon working and as I approached his convertible he noticed us and *stopped!!* We went gliding right over the top of his car—still about 100 feet in the air. Soon we were out of the range of his lights but by now I had the grayish outline of the highway ahead!!

One of the reasons you don't select roads for makeshift runways is that power lines usually follow them! When small airplanes and power lines collide, the lines seldom break and the aircraft is usually seriously damaged.

Well, at this time, the rotating beacon flashed its red beam of light in front of us—and lit up a power line!! The only one that crossed that highway for the next 14 miles!! All I could do was slam forward on the yoke. The power line struck the fuselage just above the canopy! We could hear it scrape along the fuselage until it reached the rudder —and with a "snap" it was gone —along with the rudder!! Now with a "nose-low" attitude, I yanked back on the yoke and all we heard was a squeak.

The squeak was the tires contacting the highway! Another "grease job" landing! I let the aircraft come to a stop in the ditch on the left side of the road—not a scratch or bruise on either one of us!

We were given a ride back to Laredo by the fellow and his wife, who still did not believe what they had seen. After completing the necessary calls and reports, I explained to Lisa how close we came to being seriously injured. Only then did she show any visible emotional concern!

The reason for this flight ending short of its destination was some poor maintenance. A nick was found in one of the prop blades earlier that morning—along with a small crack! They were both removed with an electric grindstone—which left the prop slightly unbalanced. This became so severe after a couple of hours of flight, it caused the crankshaft to fail at the forward main bearing. As a result, that part of the crankshaft, spinner, and prop all left the aircraft!!

Obviously, we can't supervise every bit of maintenance on each aircraft. Even if we could, equipment can still fail during normal use. We can, however, psychologically prepare our crew members to handle emergencies. Simulated emergencies can be practiced in a flight simulator. The simulator program should be realistic and have emphasis placed on *practical* emergency situations. A good accident prevention program should include this type of training. It should also be monitored closely as further insurance against a possible accident! ★

LT COL MALCOLM F. BOLTON
430 TFS Nellis AFB NV

F-111



NACELLE FIRE ANALYSIS

why the bold face emergency

The military specifications for the F-111 required General Dynamics to provide a nacelle fire extinguishing system. The General Dynamics design is a high rate discharge system which incorporates a halogenated chemical as the extinguishing agent. The specification required the system to provide a 6 percent concentration by volume of this agent throughout the nacelle for at least 0.5 seconds. The design parameter used to meet this condition was nacelle air flow at the 1.2 mach, sea level flight regime.

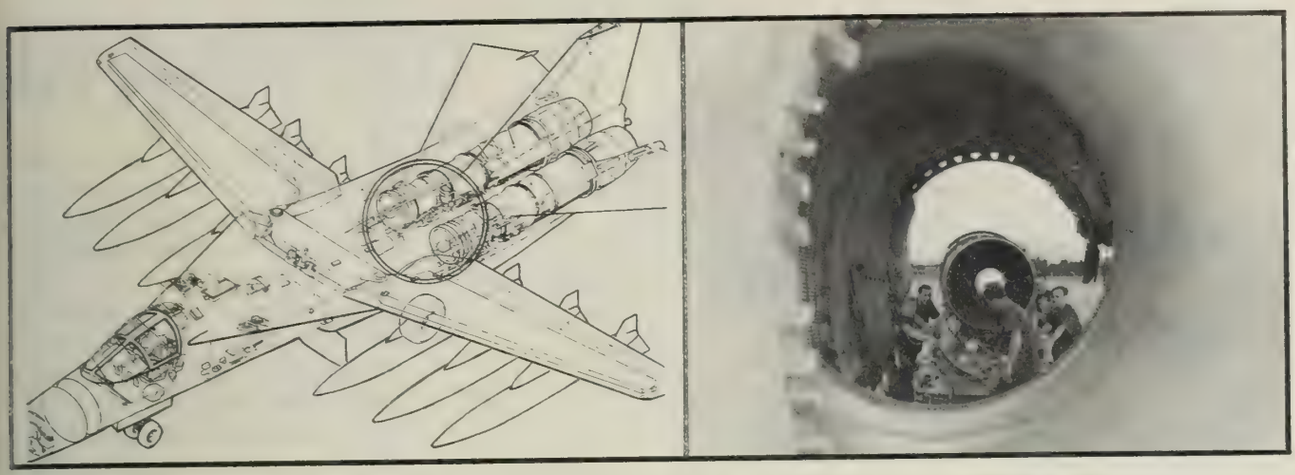
This high nacelle air flow condition (approximately 35.2 lbs/sec) with velocity ranging from 85 to 250 feet per second establishes the quantity of agent required. At any other flight condition, nacelle mass air flow rates will be less than the design point and the concentration of agent in the nacelle will be greater than the design value of 0.5 seconds. Of critical importance is that the upper limit of the agent dwell time (concentration at least 6%) for flight is only 1.3 seconds. Therefore, a crew member can never expect more than 1.3 seconds of agent at any point for fire suppression. With the one shot system in the F-111, if fuel and a source of ignition remains in the nacelle after the agent is discharged, the fire will reignite and the aircraft will be lost.

In the cases where fuel tank rupture has occurred, fuel flow was not stopped as the agent was discharged. Since tank wall rupture will always be a possibility, the problem must focus on eliminating all ignition sources within the nacelle prior to expiration of agent dwell time. Prior to discussing these sources of ignition, an understanding of the ignition characteristics of JP-4 is needed.

The Spontaneous Ignition Temperature (SIT) of JP-4 under static laboratory conditions of a sea level, standard atmosphere is approximately 435°F. SIT is defined as the lowest temperature at which a substance will ignite in air without an external source of ignition. Of interest is how SIT changes when a velocity is imparted to a JP-4 fuel/air mixture. At only 2 ft/sec, SIT elevates to 800°F, at 8 ft/sec it is up to 1050°F and by 20 ft/sec, it is up to 1200°F. Air velocities throughout the nacelle at all flight conditions are at least 20 ft/sec and most often are between 60-185 ft/sec. In other words, for something to ignite a major fuel leak in the nacelle it will have to have an extremely high temperature. By analyzing engine component temperatures, it can be seen that the engine itself cannot be an igition source.

Nacelle air temperature never exceeds 420°F. This temperature occurs under 1.2 mach, sea level conditions and is the extreme condition of the F-111 flight envelope. The hottest component anywhere in the nacelle is the 16th stage bleed air line. At 1.2 mach, sea level, it is 980°F. At 2.2 mach, it is 1000°F. Nacelle airflows under these conditions are greater than 200 ft/sec which elevates the SIT far above these temperatures. Nowhere in the flight envelope does the SIT approach the temperature of an engine component; therefore, some other ignition source must be available. The three critical ignition sources are the afterburner flame, electrical shorts and disintegrating engine rotating parts.

The afterburner flame is an obvious source of ignition. There are numerous cases of afterburner fuel line or fuel pump failure that created a fire sufficient to trigger the fire



procedure was changed...

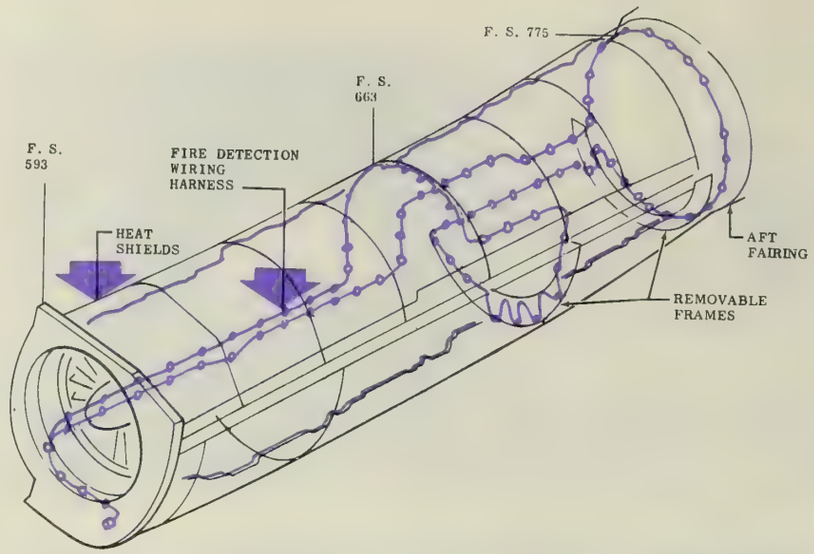
detect loop. In every case, the fire was extinguished as soon as afterburner operation was terminated—both the fuel and source of ignition were removed.

What happens when a fuel manifold ruptures and fuel streams throughout the nacelle? In looking at F-111 fire history, there is little evidence to indicate that the afterburner flame will ignite a massive nacelle fire under these conditions. Air velocities within the nacelle have already been established. Studies show that upstream flame propagation within a laminar flow cannot take place at fuel/air mixture velocities greater than 2 ft/sec. The F-111 nacelle air flow however is far from laminar and will be very turbulent throughout the nacelle. Studies show that upstream flame propagation in this case cannot take place in velocities greater than 20 ft/sec. Remember, nacelle air flow is on the average of 100 ft/sec; therefore, it becomes theoretically impossible for an afterburner ignited fire to burn forward in the nacelle. (Dumping fuel in afterburner is a vivid illustration of this phenomenon.) Nevertheless, there are far too many variables to rule this out and it must be planned for. Closing the throttle first is the logical procedure and flight test data further verifies this.

F-111 flight test data shows that 2.5 seconds is required for the nozzle to close when the throttle is retarded from maximum power to idle. Furthermore, in all cases, the afterburner flame will always be out by nozzle closure. Normal reaction times would indicate that by the time the throttle is closed, and the fire pushbutton depressed, the afterburner flame will be out by the time the agent dwell time is depleted. Again, the critical step points to closing the throttle and getting the source of ignition extinguished prior to discharge of the agent.

Concern has been expressed over ignition sources from electrical shorts due to wire deterioration in a nacelle fire. If a nacelle fire occurs, will the insulation melt and leave exposed wires which will short together to cause reignition of any fuel still in the nacelle? Although this possibility exists, the probability of occurrence is felt to be small. For one thing, as soon as the generator drops off the line, electrical current remaining within the engine bay is minimal. This alone argues for closing the throttle immediately. Nevertheless, wiring in the engine bay was designed under the assumption that the wires might be exposed to fire.

Engineers designed the F-111 engine bay wiring using two types of insulation. The generator feeder wires are insulated with a Dacron/fiberglass coating over a silicon based wire wrapping. In exposure to extreme heat, this material will char and even though it will flake off, the charred residue will still provide insulation. Furthermore, the generator feeder lines are laced through insulator blocks which physically separate them from one another. Nothing but the most violent force could cause a short. Other wiring in the nacelle is teflon coated. Teflon will melt when exposed to extreme heat but in all cases, exposure time and not total temperature is the governing criterion. All evidence suggests that the exposure time in the nacelle fires witnessed to date is too short to significantly deteriorate any of the insulation. Regardless, shutting down the engine immediately, so that the generator is disconnected prior to agent dwell time expiration, is the best possible guarantee against an elec-



F-111 Engine fire detection system.

trical short being an ignition source.

Thus far compressor disintegration has not been addressed. I feel it is the most serious hazard to survival of a nacelle fire. Of all the engine fire procedures, closing the throttle as the first immediate step becomes absolutely critical under compressor failure conditions. Rotating engine parts become a continuous source of ignition if the engine is allowed to run.

The TF-30 engine fan case and compressor rotor are constructed of titanium alloy. The energy required to penetrate the fan case with a compressor blade will generate a temperature at the fracture of 2000°-2500°F. In addition, with the engine compressor components breaking up, the probability is high that internal engine parts will rub together. At normal N_2 rpm, metal to metal contact will produce temperatures of at least 2000°F in fractions of a second. If one of these superheated parts enters the nacelle, it will ignite the fuel even at the highest air flow within the nacelle. The point is that unless the throttle is cut off, the engine will continue imparting high temperature engine fragments into the nacelle air flow.

Consider a typical case seen thus far. The crew hears or feels a thump. Engine instruments appear normal but almost immediately a fire light is on. The old procedure required the pilot to depress the fire pushbutton to cut off fuel to the engine/nacelle area and then discharge the agent. From previous discussion, the agent will last a maximum of 1.3 seconds and during this time the fire will be extinguished. Now observe what the engine is doing. At cruise conditions of approximately 6000 lbs per hour fuel flow, the engine will continue to run for up to 17 seconds. Even at a maximum power where fuel flows are 36,000 lbs per hour, it will run for 2.7 seconds. The point is that the engine is still running at whatever rpm the throttle is demanding after all agent has vented from the nacelle. The compressor, now failed, is still running at normal power! The probability is very high that it will continue to disintegrate and impart high temperature particles of titanium into the nacelle. The agent is gone, the fire reignited and the aircraft will be lost.

Unfortunately only one statistic is available to substantiate this position. Approximately 10 minutes after departure, the right engine/3rd stage compressor rim failed. It exhibited identical failure modes to the recent F-111 failures. The aft fuel tank and saddle tank were ruptured. High temperature parts of the engine were identified as the source of ignition and a very intensive fire resulted. Bold face procedures called for the first step of an in-flight fire to be throttle off, then pushbutton depress followed by agent discharge. The pilot followed these procedures, the fire was extinguished and the aircraft was safely recovered. Throughout the recovery, fuel from the punctured tanks continued to stream through the nacelle; however, it never reignited!

It is absolutely imperative to get the engine shut down immediately. Without an afterburner flame, with the generator off the line and with the compressor rotor at windmill rpm, the probability of a successful recovery is greatly improved. ★

Reference for hydrocarbon flame propagation rates in laminar and turbulent flow:

Barnett, Henry C., and Hibbard, Robert R., "Properties of Aircraft Fuels," NACA TN 3276, Aug 1956.

Reference for stay time of extinguishing agent in F-111 nacelle:

McClure, J. D., and Pringer, R. J., "Environmental and Operating Requirements for Fire Extinguishing Systems on Advanced Aircraft," JTCG/AS-74-T-002, January 1974.

McDonald, N. R., "Airframe—Fire Extinguishing System—Ground Functional Test," Convair Aerospace Report FGT-5428, 14 Mar 1968.

UNWANTED LIFT

MAJOR ROBERT L. GARDNER
Directorate of Aerospace Safety



Hey, all you aero clubbers and light plane buffs! Have you ever dinged a wing tip or curled the ends of the propeller on your little bug smasher?

It's not hard to do; in fact, it has happened to a couple of aero club pilots recently. In both cases the aircraft were on the ground when one wing began to fly. Here is what happened.

INCIDENT ONE

A Cessna 172 was cleared to land number three behind two Navy P-3 aircraft. The first P-3 made a touch-and-go and was on downwind when the Cessna landed. The second P-3 had made a full stop and was at the end of the runway awaiting taxi back approval. The Cessna 172 pilot landed long to expedite a turn off at midfield. The landing was normal with no side drift. But, shortly after touchdown the left wing was raised by a gust of wind or a lingering wing tip vortex from the P-3 aircraft which had previously landed. The aircraft swerved left and the propeller and right wing tip struck the runway surface.

The pilot recovered directional control after leaving 150 feet of tire marks. He then cleared the runway and taxied to parking for damage assessment. The propeller tips were bent to the rear about three inches and the right wing tip fairing and outer wing tip panel skin were scuffed and torn on the lower side.

INCIDENT TWO

After landing on the active runway an aero club aircraft was directed by tower to turn off at the first taxiway, although a C-130 was holding short for takeoff at that intersection. Another C-130 was in an adjacent run-up area performing a maintenance engine run. There was not enough clearance to exit to the left of the holding transport, so the aero club pilot passed in front of this aircraft and turned off on the asphalt stabilized shoulder of the run-up area. Due to insufficient room to taxi between the C-130 in number one position and the one on the run-up pad, the light plane pilot continued on the asphalt shoulder and taxied behind the transport making the ground run. The prop blast caused the light plane to veer sharply right lifting the right gear off the ground resulting in left wing tip-to-ground contact. The dragging wing turned the aircraft back to the left and the nose dipped with the prop striking the ground. The pilot shut down the engine as the aircraft continued around to the left coming to rest on its left wing tip and nose. The aircraft then rocked back on its main gear and the pilot restarted the engine and taxied clear of the C-130s.

In this case the left wing tip was dented and both prop blades were bent.

LESSONS LEARNED

These two incidents emphasize that light airplanes want to fly, sometimes even on the ground. Unfortunately the asymmetrical lift generated by unequal airflow over the wings results in rolling moments which may be impossible to control. Wake vortices, wind gusts, propeller and jet blast, and helicopter rotor wash can spell trouble especially for light aircraft. When these phenomena are encountered during takeoff or landing, loss of control may occur resulting in an accident. As pointed out by the above examples, aircraft damage may occur when we tangle with these conditions during ground operations.

Since wind gusts, vortex, and prop or jet wash air velocities are not usually detected by visual clues, pilots must be alert for the conditions and factors which generate them. Light aircraft should not be operated in the accelerated turbulent airflows caused by jet engine or propeller wash. Likewise, helicopter down wash and the wake of larger aircraft should be avoided.

Sometimes controllers and pilots are led to believe clearance is adequate and unwittingly and needlessly permit exposure to hazardous conditions. Remember to give yourself plenty of room and never stop flying your aircraft until it is in the chocks. ★

FIGHTER



CAPTAIN JOHN E. RICHARDSON
Directorate of Aerospace Safety

During the air combat over North Vietnam, it became apparent to USAF and Navy tacticians that our kill ratios were much too low. This problem was the subject of a special study in 1968. The study identified many deficiencies of which one major contributor was poor aircrew performance in combat. Part of the problem was that there was no realistic method of teaching pilots to recognize the proper missile firing envelopes and to simulate combat against a maneuvering enemy.

In an attempt to solve the training problem, the Navy developed the Air Combat Maneuvering Range (ACMR). This system is established at the Marine Air Station, Yuma, Arizona and NAS Miramar, California. It consists of remote and unmanned tracking stations, a master station, control and computation vans and facilities for display and debriefing.

The ACMR uses advanced electronics and computer technology to augment the actual air-to-air combat training engagements flown on the Yuma ranges.

The aircraft are equipped with an Airborne Instrumentation System (AIS). This component of the system looks like an AIM-9 sidewinder and gets its power directly from the aircraft weapons bus. The AIS can operate on any aircraft capable of carrying external stores. The AIS transmits all flight maneuvering missile parameters and actual aircraft performance to the remote ground stations. These remote stations then pass the data to the tracking, control and computation and finally the display stations.

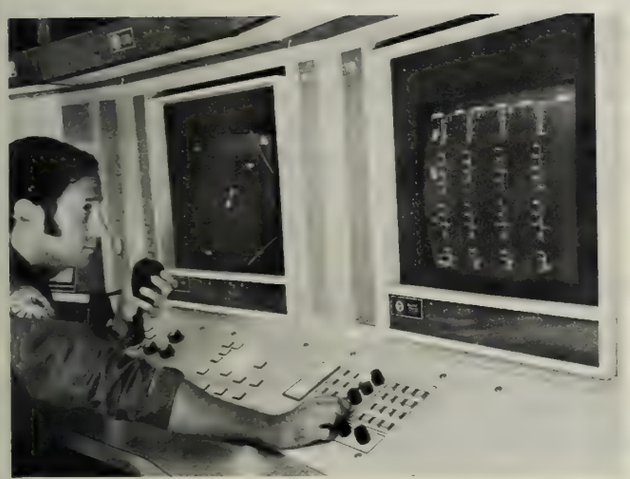
At the display station, the ground instructor pilot (GIP) has all the information he needs to monitor and instruct the pilots engaged in the ACM training. The GIP has three displays. On one he sees the aerial situation. This situation is three dimensional and displays the entire battle from any angle or range through 360°. The display also provides a past position indicator which shows the flight path of the engaged aircraft.

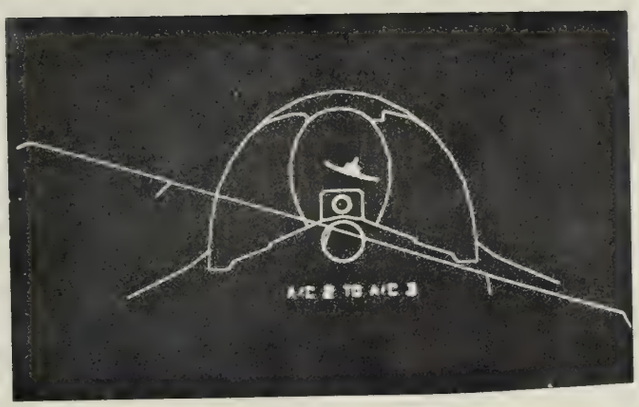
The other two screens provide alpha numeric information on types of aircraft, weapons, status, pilots, and critical flight parameters (g load, closing velocity, etc.). The system also has the capability for the instructor to insert safety limits for each parameter. Then, when an aircraft approaches the limit, such as minimum altitude, the display of that aircraft begins flashing and the instructor hears an audio tone.

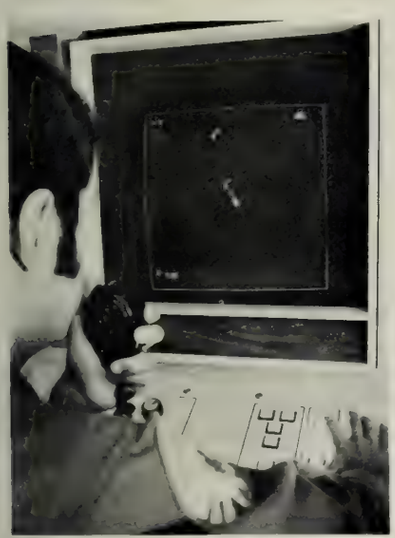
The computer has been programmed with the operational parameters of the AIM-7 and AIM-9 missiles. As the battle progresses, the flight data is fed into the computer. When a pilot presses the trigger to simulate a missile firing, the computer automatically assesses all the parameters, g loads, cockpit switch position, range, etc. The launch is displayed on the aerial situation display by a ribbon emanating from the aircraft and tracking the enemy. If all flight and launch parameters are met, the computer registers a "kill." The average time from launch to "kill" or "miss" report is displayed in about 10 milliseconds. The instructor can then relay the information to the pilots within seconds of the occurrence. Thereby establishing and reinforcing the visual clues to proper missile launch parameters.

The computer also makes a record of the entire mission so that the GIP has the information for use in

PILOTS
even "simulate" it







Lt Commander Kent Stauss, VF-1 Sqdn at Miramar NAS, CA, monitors a live dogfight training exercise (top photo). Line between aircraft 1 and 3, lower photo, is trajectory of the fired missile weapon system.

debriefing. This is the second great advantage to this system. One of the most difficult things an ACM instructor must do is teach a student how to perform the basic air-to-air maneuvers, when the only tools are his hands or model airplanes on sticks. Now the ACMR display can show what successful and unsuccessful maneuvers look like not only in plain view, but actual cockpit view as well. The display gives the student total recall of the mission. Each maneuver can be reviewed and analyzed, greatly increasing the value of each training sortie. Finally, this training has the advantage of avoiding the use of costly live missiles and targets while actually providing a more realistic combat environment.

While the ACMR is a very effective system, the Air Force is already working on an improved system. Called Air Combat Maneuvering Instrumentation (ACMI), it differs from ACMR primarily in updated technology and other improvements which provide more flexibility. These improvements include: increased cockpit view capability, ability to handle increased numbers of aircraft on the range; the Navy system can handle four maneuvering aircraft, ACMI will handle eight. The ACMI programming will allow realistic hostile environment simulation by including data on current Soviet missiles.

In this time of austere funding and increasing costs, it is vital that every hour of flying time be productive. Spokesmen for the Navy Fighter Weapons School estimate that use of the ACMR has increased aircrew accuracy to the point where they are putting 85 to 90 percent of their shots on target. This and the value in research and development make the ACMR a most promising development in the technology of air combat. ★

OPS TOPICS

FLYING SAFETY OFFICERS

HQ AAVS has extra copies of The Aircraft Accident Investigation Board training films. These super 8 cartridges are numbered FR 1427A through E, and are available at your local film library.

THE PEN PULLED IT!

EOD was notified by the Base Ops Crash Phone that a flare had functioned inside a helicopter on the flight line. An EOD team was dispatched and found an MK 6 Float Lite burning on the flight line approximately 200 feet from a helicopter. The flare had been removed from its packing container for possible use during a rescue mission. It was not used, however, and when a crew member picked the item up after the flight, the igniter was pulled by a pen protruding from his shirt pocket. The crew member carried the burning item from the helicopter, and it was allowed to burn out while the fire department stood by.

CRACKED FLOOR

The T-38 was on a mission, one leg of which required the crew to wear under arm LPU's. On the next leg, since the LPU's were not required, the IP stored his under his ejection seat. When he lowered the seat it contacted the LPU. This pressure plus the stress of cabin pressurization was enough to rip the sheet metal floor of the cockpit. The crew became aware of the failure when they lost cabin pressure during the climb to altitude.

RESCUE RECORD FOR '75—824 SAVES

The aircrews of the Aerospace Rescue and Recovery Service saved 824 lives during 1975. In addition to the many other saves world-wide, they rescued 152 in support of the *S.S. Mayaguez* operation.

The ARRS celebrated its 30th anniversary on March 13th. The record of service of ARRS crews since 1946 has been exemplary. We, the staff of *Aerospace Safety*, join with the rest of the Air Force in wishing a happy anniversary and continued good fortune to all in the Aerospace Rescue and Recovery Service.

FAILED TANK

During a routine air refueling, the F-4 crew heard a thump and then saw fuel venting from the right external tank. Both the wingman and the boom operator confirmed the venting fuel, so the crew terminated refueling and returned to home base. Both tanker and receiver had used proper procedures. However, this was the first flight in quite a while with external tanks installed. It is probable that the tank pressurization and vent valve had collected moisture and subsequently froze at altitude. Thus, when the refueling was started, the increased pressure caused the tank to rupture.

HE FLEW THROUGH A WHAT?

The F-4 was returning to base from a forward location in IMC under radar control at FL310. The crew was aware of a reported volcanic eruption and had altered course to remain at least 20 NM upwind. However, without warning, the aircraft entered a cloud of volcanic ash. Although the aircraft was only in the cloud for about 90 seconds, the ash scoured the windscreen canopies and leading edges of all surfaces. What's the weather symbol for volcanic ash?

OPS TOPICS

WRONG IDENT

Recently an approach controller mis-identified an Air Force C-9 and gave it an incorrect vector. The reason for the mistake was that another aircraft had idented when the controller requested an ident from the C-9. In addition, the other aircraft followed the instructions for the C-9. The FAA controller has a difficult enough job without such added problems. It is more than just a violation of regulations to ident and follow instructions for another aircraft. It is dangerous. In this case the C-9 was in mountainous terrain. Only the C-9 pilot's awareness of his position prevented a more serious mishap.

T-39 GEAR ACTUATOR END CAPS

Another T-39 has suffered a hydraulic actuator end cap failure. Fortunately, the pilots recognized the symptoms and made an uneventful landing. A new procedure is in the mill for the next dash one change but until we get it, be sure you know the system and the symptoms of the various gear malfunctions.

GROUND EGRESS

The F-101 had a problem on landing and departed the runway. There was no serious damage; loss of control was due to a failed nose gear actuator bracket. However, the problem encountered by the WSO on egress was more serious. After the aircraft came to a stop, the pilot told the WSO to "get out." The WSO interpreted this to mean emergency egress. When he attempted to release the survival kit, he had difficulty rotating the handle far enough to release the kit. This, plus difficulty in locating the handle, led the WSO to elect to egress wearing kit and parachute. He crawled over the canopy rail, then lost his grip and fell to the ground suffering some slight injuries. The WSO had received emergency egress training, but evidently the stress of the situation, plus some unclear procedures in the dash one, led to his mishap. How long has it been since you *really* practiced an emergency egress? You might need the knowledge in a hurry.

REFUEL PROBE—UH DRAG CHUTE—EXTENDED

The F-105 was nr 3 in a night air refueling mission. The pilot comple refueling checklist but inadvertently pulled the drag chute han than that for the refueling probe extension. The chute function and the pilot then jettisoned it and returned home for a revie procedures and cockpit "switchology." ★

ANNUAL REUNION

The 366th TFW Gunfighters Association will hold May 1976 at the El Tropicano Hotel, San Anto Frank Mercy, Gunfighter Reunion Committ Texas 78148, or phone 1-512-653-8339. All of the 366th TFW since the Wing's activ Gunfighters Association and attend the

LASER TARGET DESIGNATOR SCORING SYSTEM



A new system developed by Air Force Systems Command's Armament Development and Test Center (ADTC) will be a boon for training tactical aircrews in the use of laser target designators.

Called the Laser Target Designator (LTD) Scoring System, the new device acknowledges the presence of laser pulses and instantly notifies aircrews that they are on target. The new system can also be easily carried by two people and transported in the trunk of a car.

During a training exercise, LTD
be set up quickly at a target
or scored at a tactical range.
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Lt Col EDWIN R. MAXSON

56th Special Operations Wing (PACAF)

APO San Francisco, CA

On 27 June 1975, Lt Col Maxson, with a crew chief passenger, was leading a flight of two OV-10s from Nakhon Phanom AB to U-Tapao AB, Thailand. On downwind Lt Col Maxson lowered the landing gear but the left main gear would not extend although the right and nose gears indicated "down." Lt Col Maxson retracted the gear and went around, requesting his wingman to close for a gear check. The wingman joined on Lead's wing and the two aircraft departed traffic for attempts to lower the gear. When it became evident that the gear would not lower, Lt Col Maxson and the supervisor of flying conferred and decided upon a gear up landing on foam. Lt Col Maxson jettisoned his external fuel tank and had his passenger install his ejection seat safety pin (the seat could still be ejected by the pilot). Enroute from the jettison area to the pattern a landing attitude stall was performed with propellers at flat pitch to determine stall speed. Stall was indicated at 72 kts. Final approach was established at 85 KIAS and all final checks were made by the pilot and his passenger. An uneventful landing was made in the foam with only minor damage to the aircraft. Cause of the gear malfunction was a broken main landing gear uplock bellcrank connected to the bungee that opens and closes the gear doors. By his calm, professional handling of this emergency, Lt Col Maxson prevented possible injury and damage or loss of an aircraft.

'LL DONE! ★

☆U.S. GOVERNMENT PRINTING OFFICE 1976 789/855/32

TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



Capt ANTHONY L. LIGUORI
911th Tactical Airlift Group (AFRES)
Greater Pittsburgh Intl Airport
Pittsburgh, Pennsylvania

On 19 May 1975, an Air Force Reserve C-123K crew commanded by Captain Liguori was participating in a paratroop drop mission at Fort Benning, Georgia. The aircraft departed Lawson Army Airfield enroute to Friar drop zone with a flight crew of eight, 36 student paratroopers, two jump masters and two qualified jumpers who were to act as wind testers. When the six minute warning was called, the paratroops stood up and prepared to jump. Captain Liguori began a left turn from downwind to base in the drop pattern when he felt a snap in the aileron controls, the yoke went to full left deflection and the aircraft began a roll to the right. Captain Liguori continued to hold full left aileron, applied full left rudder, advanced power on the right recip engine and directed the copilot to bring the right jet to 100 percent. As the right jet reached full power the roll to the right stopped and aircraft control was regained. By holding full left aileron, full left rudder and differential power Captain Liguori was able to maintain wings-level flight; however, aircraft control became marginal at speeds below 130 knots. Due to the high airspeed required to maintain adequate control, it was decided to attempt a landing with the paratroopers on board rather than continue the drop as this was to be their first actual jump. Captain Liguori was able to maneuver the aircraft to a position where a no flap, straight-in approach was flown using full aileron and rudder, and differential power for directional control. After landing it was discovered that the right aileron down control cable had broken allowing the right aileron to go to the full up position. Captain Liguori's reaction to an emergency situation of unknown cause and his superior airmanship prevented the loss of a valuable aircraft and the lives of the 46 persons on board. WELL DONE! ★





FROM WHENCE WE CAME

0820, April 18, 1942. The pilot released brakes and the aircraft lumbered down the flight deck into the teeth of a squall.

That pilot in the lead aircraft was Jimmie Doolittle, then a lieutenant colonel in the U.S. Army Air Corps. And he was leading 15 other B-25 "Mitchell" bombers on the historic raid on Tokyo by land based bombers launched from the deck of an American aircraft carrier, the Hornet.

Doolittle's raiders wrote a chapter in the rich history of the U.S. Air Force that ranks with the many great moments "from whence we came."

For the story of the Doolittle raid and more photos, please turn to page 14.

Top left. B-25 Mitchell bombers fill most of ca deck during Pacific crossing.

Top right. Lt Col Jimmie Doolittle fastens a meda had earlier received from Japanese to a bomb for turn trip.

Bottom left. Wreckage of Doolittle's plane on Chi hillside.

Bottom center. Doolittle crew, left to right, SSg A. Braemer, SSgt P. J. Leonard, 1st Lt R.E. C Doolittle, and unidentified Chinese.

Bottom right. Four Tokyo Raiders with Chinese frie







Near right. Missionaries who helped downed flyers in China by providing refuge from Japanese searchers.

Far right. Decoration of Tokyo Raiders by Madame Chiang Kai Shek at Chungking, China. Brig Gen James Doolittle.





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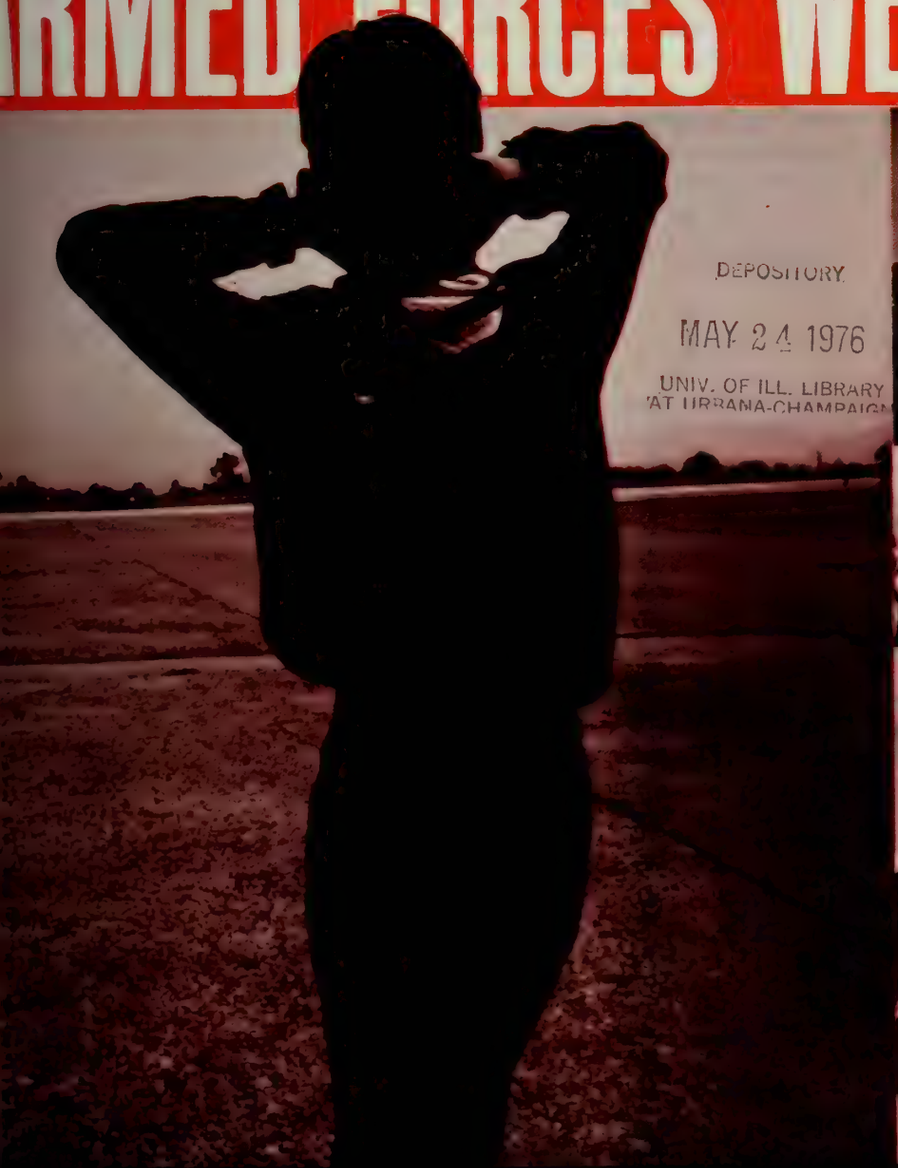
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SAFETY MAY 1976





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UNITED STATES AIR FORCE MAY 1976

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THE MISSION - - - - - - SAFELY!

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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MAY 1976 AFRP 127-2 VOLUME 32 NUMBER 5

COMING!

SPECIAL FEATURE FOR AIRCREWS... SURVIVAL

CAPTAIN RONALD E. VIVION
Chief, Programs and Current Operations
3636 CCTW, Fairchild AFB WA

Survival training. I'm sure that very term elicits a definite and different mental picture for each aircrewman. Some remember the August week they spent sweating through the deadfall and slash north of Fairchild. Others still can't figure out how that Negrito could hide so well in the jungle. Of course, there's Miami in the winter (yes, salt water really is salty). Choco Indians appearing from, and then disappearing into, nowhere, and let's not forget beautiful downtown Alaska at −40 degrees Celsius. But for most aircrew members, survival is just a memory, or better stated, not an ongoing part of their aircrew duties.

We, of the Survival Wing Staff, feel that our first shot (no pun intended) at you, gave the basics of survival. To be an effective survivor and really make the "That They Shall Return" system work, you need to be reminded of all those "woodsy-did-you-know" things we provided at the schools. To this end, we are taking a lesson from the very fine articles on Instrument Procedures, written by the folks at IFC, that appear monthly in this publication. Starting with next month's *Aerospace Safety,* and each month thereafter, we will produce articles pertinent to a particular facet of survival. They are intended to help refresh your memory, and in some cases, provide information that isn't available because of school closures.

In any case, they will be here for you, the aircrew member, to review and use. Of course, we wholeheartedly hope that the skills of survival won't be necessary, but the odds aren't in our favor.

To help us in this enterprise, we solicit your support and comments. If you have a particular subject that you would like emphasized, please let us know. Also, if you have specific questions that can be answered via a phone call or letter, we'll be glad to accommodate. Please address any correspondence to:

3636 CCTW/TTP
Fairchild AFB WA 99011

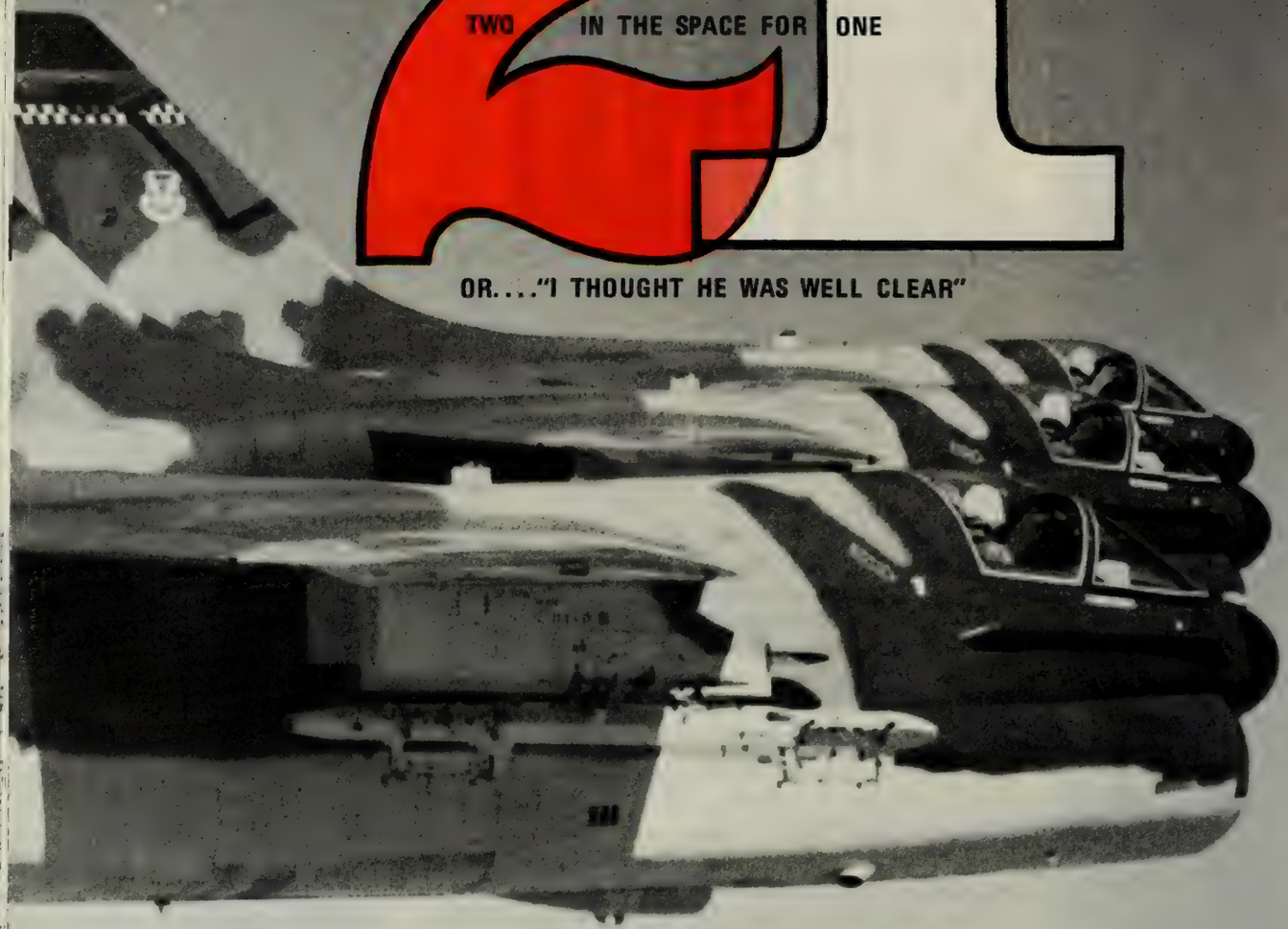
or call AUTOVON 352-5470. ★





2 TWO IN THE SPACE FOR ONE 1

OR...."I THOUGHT HE WAS WELL CLEAR"



MAJOR BRIAN C. BERNET, CF
Directorate of Aerospace Safety

Midair collisions destroyed 189 USAF aircraft during the 11-year period from January 1965 through December 1975. This is one heck of a drain on our limited resources. We have learned many lessons during the last 11 years, but apparently not all have been learned well enough because we started 1976 by losing four fighter aircraft during the month of January.

Many words have been spoken during preflight briefings about operational rules and procedures designed for our safety, but we have accidents to prove some do not always follow them. Most of the time, everyone does a first class job, but every now and then a bad situation develops. I am sure every fighter jock has been involved in or witnessed a situation that was "pretty close." Some avoid a midair by knowledge and skill, others are lucky, and far too many——collide!

I hesitate to preach too loudly to you first line jocks in the field about the latest intricacies of formation flying, intercepts, ACM or the specific details of what is safe and what it not. What I can do, however, is describe briefly three recent accidents and let you decide for yourself what mistakes were made.



● A flight of three was performing a two-on-one, self set-up, tactical hook ID intercept to be followed by an ACM engagement. The lead interceptor was in search mode. He pulled up at 6 NM to a 60 degree nose high position, but lost radar contact with the target when it was 40 degrees left at 2 NM and level. The wingman was flying a radar-out shooter position. Shortly after Lead began his pull-up, the wingman began a right chandelle assuming the target was at Lead's 12 o'clock position. The target actually was 4000 to 6000 feet to the left.

About this time, the target saw both attackers and commenced a descending turn toward the wingman, and shortly after decided to attack the lead aircraft. To do so, he rolled into a left climbing turn which caused his wing to block his view of the wingman. His WSO could not maintain radar contact with both aircraft at this short range because of altitude differential. The wingman collided with the target aircraft, his left wing contacting the target's aft fuselage.



● The lead pilot of a formation was on his first night VFR traffic pattern. The overhead pattern was normal with spacing on downwind at 3000 to 4000 feet. When about to turn base, Lead decided to break out of the pattern due to conflicting traffic. While attempting a rejoin, the IP took his eyes off lead to adjust his cockpit lighting and check his airspeed. When he looked up he did not see Lead's rotating beacon, so he transmitted "turn your beacon on." Lead knew his beacon was on, thought there must be a misunderstanding, so turned it off. The IP saw a beacon approximately where he thought Lead should be and attempted to rejoin, but it was not Lead. He collided with Lead without seeing him.



● A flight of two was making a night weather penetration. Number two was a NORDO aircraft on Lead's left wing. Lead successfully used a visual signal for gear extension. However, the wingman did not see the visual signal for flap extension or see lead's flaps extend. The wingman was unable to maintain normal formation position due to lead's deceleration. Relative to the lead aircraft, the wingman began moving under and to the right, reaching a point slightly ahead of a normal formation position and to the right of the lead aircraft centerline. From this position, he began a cross-under to the left to regain his original position. During the cross-under, he collided with Lead.

There are two types of midair collisions. One is where two aircraft of the same flight collide. The other type is where two non-associated aircraft collide, with the crews probably unaware that they were in close proximity or on a collision course. The USAF lost eight aircraft in a recent 3-month period in the first type of mishap. Let's look at the last 11 years experience to give you a feel for where a collision between aircraft of the same flight is most likely to occur.

Collision between members of the same flight accounted for 64 percent (172) of the total number of midair collisions. Out of a total of 92 collisions in close formation, only five occurred in weather and five at night. All intercept collisions occurred in visual conditions: 11 were between members of the same flight and seven were at night. Approximately 50 percent of all collisions between aircraft in close formation resulted in the loss of both aircraft.

A breakdown of these occurrences is as follows:

COLLISION OF AIRCRAFT IN THE SAME FLIGHT BY PHASE OF FLIGHT
1 January 1965 - 31 December 1975

Phase of Flight		Number of Occurrences
Takeoff:	Roll	11
Climb:	Initial	12
	Prolonged	7
Cruise:	Straight & Level	28
	Turning	23
Descent		6
Landing:	Initial	3
	Pattern	3
	Final	7
	Roll	19
Go-Around		2
Air/Air:	Intercepts	11
Air/Ground:	FAC	1
	Delivery	1
	Recovery	1
	Pattern	2
ACM		17
Acrobatics		8
Air Show		7
*Other		3
		172

*Other includes: F-84F knocking lead's gear down.
F-106 breaking in front of target.
O-1E unauthorized close formation.

COLLISION BY AIRCRAFT IN THE SAME FLIGHT BY TYPE FORMATION ACTIVITY
1 January 1965 - 31 December 1975

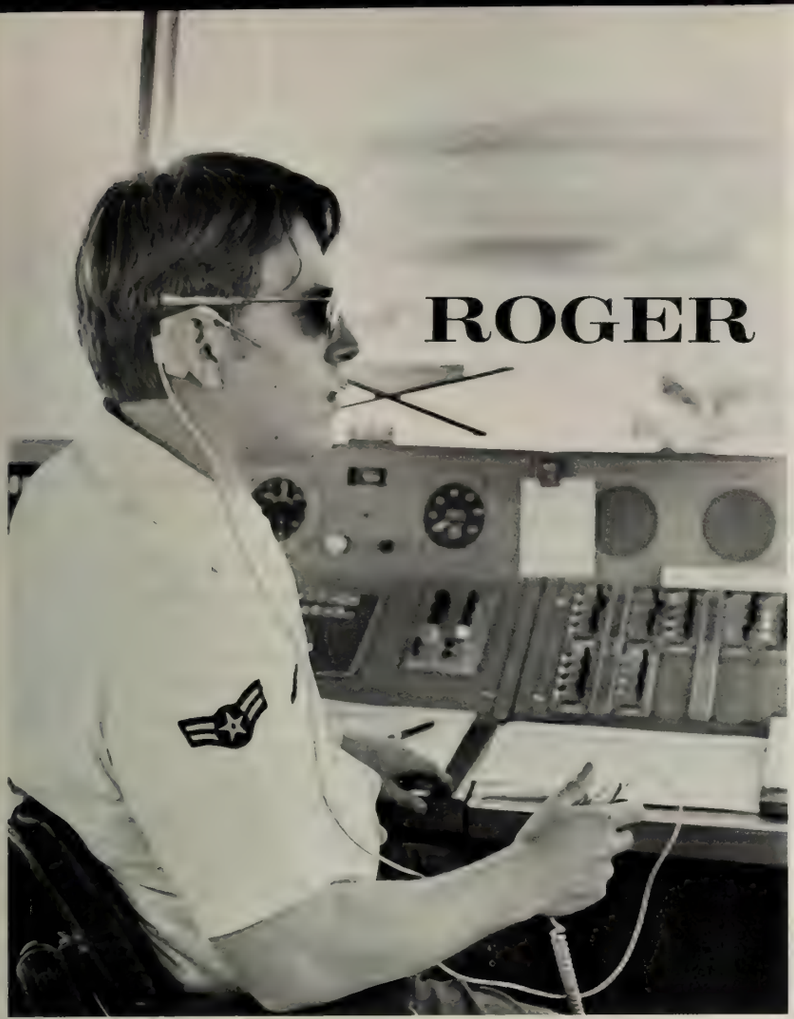
Type Activity	Number of Occurrences
Close	92
Route	3
Trail	10
Join/Rejoin	26
Crossover/Under	4
Change Lead	3
Tactical	3
Fighting Wing	8
ACM (Attack Phase Only)	7
Air/Air Intercepts	11
Air/Ground Pattern	2
Other	3
	172

Data provided by Safety Analysis Branch, AFISC.

If we consider pure numbers only and disregard the amount of exposure to the different types of formation, the most hazardous activity is close formation in *visual conditions.* During the last 11 years, 82 of the close formation collisions occurred during daylight VMC. The next most hazardous activity is joining or rejoining formation. This resulted in 26 collisions of which six were at night. The third most hazardous single activity is an air-to-air intercept.

Having looked at the statistics, what are some lessons learned? Any flying maneuver which places two or more aircraft in close proximity requires a great amount of mutual aircrew discipline. Each aircrew member in a flight or formation must clearly know where the other aircraft are and what they are doing. Problems arise when something unusual occurs or someone gets out of position. Flight discipline becomes particularly essential when a flight member loses sight of his element or flight lead, or some other aircraft he should be tracking visually. This is not the time to freeze and merely hope Lead will reappear, or to expect the other aircraft will see you and take avoiding action.

Aircrews must know and clearly understand the proper breakaway procedures required if they lose sight of Lead or the other flight, whether it is day or night, VFR or weather formation, or intercept/ACM practice. Supervisors should emphasize to their aircrews—*do not try to regain formation position if there is risk of collision.* Discipline or judgment, whatever name you choose, requires that aircrews take immediate and positive action to reduce the possibility of collision. The other flight members should be advised immediately of what is happening. Remember, a breakaway in the safest direction with clear airspace is worth any loss of ego, or chewing out in debriefing, for having executed a poor maneuver. ★



ROGER Means Everything But Negative

CAPTAIN GREGORY ULRICH
22d Air Refueling Squadron
March AFB CA

According to the *Airman's Information Manual,* the definition of "roger" is "I have received all of your last transmission (to acknowledge receipt, shall not be used for other purposes)." Unfortunately, the definition is contrary to common practice and represents an insidious weakness in aircraft communications.

In several accidents, radio terminology has either been listed as the cause or it contributed in some degree to the problem. In one case an aircraft was well below the assigned altitude and descending at the rate of 1200 ft per minute. A controller observing this on radar asked rather ambiguously, "Eastern 401, how are things coming?" The crew, which was working on a system malfunction, apparently interpreted the transmission as a reference to the malfunction and never noted the deviation in altitude. The crew was unaware that the altitude hold function of the autopilot was not engaged. Less than one minute later the aircraft crashed, killing more than 100 people. The correct terminology used by the controller should have been "verify present altitude."

In another incident, an aircraft was advised twice by a GCA controller of conflicting traffic. The pilot replied "roger." Moments later the aircraft collided with a light aircraft and all occupants of both planes were killed. The GCA controller stated he believed the crew members had the traffic in sight when they replied "roger."

The final case is the TWA Flight 514 that crashed while on approach to Dulles Airport in December of 1974. The flight crew misconstrued an approach clearance as clearance to descend. On the same day, a previous aircraft did not understand a clearance similar to the one issued to Flight 514. The other crew questioned the clearance and received additional instructions. They are alive today.

The line of continuity I wish to draw between these accidents is that there is no room for interpretation when air traffic control is involved.

The following points, which apply to all radio calls, will help reduce the volume of traffic on congested frequencies and aid the controller in determining exactly what the pilot is asking for. If at any time the instructions are vague or any crew member is not clear as to the procedure to follow, the pilot should question the controller. When issued traffic advisories, the pilot should reply with "in sight" or "tally-ho." If traffic is not visible, he should report "not in sight" or "no joy."

In all radio communications, brevity is imperative. Keep calls concise and specific. Use the vernacular common to aviation to the maximum extent possible. As an example, the term "request" rather than the phrase "we would like to . . ." helps eliminate wordy confusing messages.

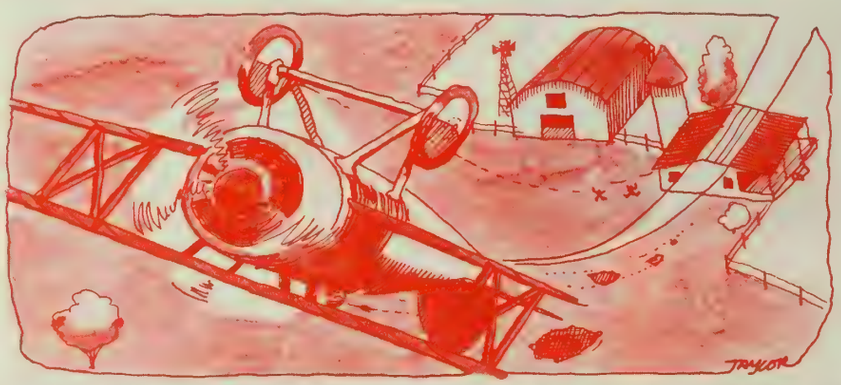
The FAA is in the process of publishing a pilot-controller glossary which will consolidate aviation terminology. It should be available in May 1976. Also, there is a glossary of aviation terms in the *Airman's Information Manual,* Part I.

Finally, the term "roger" should only be used by the pilot when he wants to say "I have received your last transmission." That is all it means. ★

OF EMPTY COCKPITS--- STORAGE SPACE--- AND THINGS---

MAJOR LAWRENCE E. WAGY, Directorate of Aerospace Safety

Rumor has it that a famous (if not too bright), early aviator took some morbid pleasure in "bombing" friends' houses with 100 pound sacks of horse manure. I also have heard he had few friends. His loading procedure apparently involved placing the "bomb" in one open air cockpit of his two cockpit flying machine. His bombing technique was to make a low altitude pass over the target, roll inverted and let the "chips" fall where they may. It is not known if his fatal error was in the loading phase or during delivery. Investigators found the remains of the "bomb" lodged in the controls and deduced that insufficient forward stick was available for the inverted portion of the flight.



I recall a similar incident that occurred during a tactical "war game" at a deployment base beyond the blue Mediterranean. This particular exercise involved my setting alert with an F-100F, an imitation bomb, a low level map, a range target, and $5.40 poker money. After a day of loading my bomb, studying my target and losing my money, the alert whistle sounded and off I ran to make a 15-minute launch. As I scrambled up the



ladder, a very old and wise sergeant ran up behind me to strap down the unoccupied rear seat; but being a young and not very experienced 1st lieutenant I ordered him away from my aircraft. I made my take-off, flew my low level and missed my target. On the way home I soothed my wounds by practicing inverted flight.

When I returned to base for an overhead pattern, the most I could accomplish was a 60-degree bank, knife-edge pass down the runway. Much to my surprise I found I didn't have enough back stick to turn the aircraft. I was eventually able to land by using the thrust lever as an up and down lever, but I aged quickly in a brace and explaining to the squadron commander how the rear seat pack got between the stick and the seat.

Obviously I wasn't surprised in early 1974 when a solo student pilot in a T-38A rediscovered "Wagy's Law" that an unsecured rear cockpit seat cushion must always end up between the stick and the seat. He also recovered with an exciting straight-in approach and a brace in front of the commander.

In 1974, a friend, and highly experienced F-100 instructor pilot, packed an empty two-seater rear cockpit in a way that interferred with the throttle. He crashed and was killed when he attempted a reduced thrust approach at night.

A few years ago, a pair of T-37B pilots were returning from a cross-country flight to a southwestern US airbase. The ramp temperature was above 100 degrees F when they taxied clear of the runway. I responded to their emergency call and discovered the crew was about to explosively remove the canopy which refused to open in any other way. An enterprising crew chief passed a wrench to the crew through the emergency jettison door and they proceeded to disconnect the canopy from the actuator. As the very dehydrated crew was being carted off to a cooler area, we found their clothes bag had been eaten up by the canopy actuator, locking the canopy in the down position.

Recently a T-38A crew packed an unneeded LPU under the ejection seat, lowered the seat and cracked the cockpit floor. This incident sounds mundane but it takes very little imagination to envision much more serious results.

A realistic approach to aircraft packing problems must concede that when a fighter/trainer type aircraft and crew leave their home grounds for greener pastures and wetter waterholes, we can expect them to carry at least a change of socks. The responsibility for seeing that aircraft are correctly packed and unneeded equipment is properly secured does not rest solely with the pilot. Supervisors must define baggage/equipment limits and provide instructions for securing this baggage in consonance with available storage space.

Although travel pods can be a partial solution, they do not alleviate concern. Scehduling cross-country aircraft to insure the correct configuration can be a difficult proposition. Aircraft aborts and last minute schedule changes may result in a pilot arriving at the aircraft with everything but his kitchen sink, only to find an aircraft without a travel pod. The golf clubs or the tennis rackets are likely to go anyway.

Supervisors face a two-fold problem. When storage space is scarce, the question is basically "where will the pilot put it?" When storage space is ample, the question may be, "what will the pilot put in it?" Center of gravity computations do not normally account for removal of 150 pounds of ammo cans to be replaced by 20 pounds of glad rags. Nor are computations made to include 45 pounds of live Maine lobsters packed in dry ice in the forward electronics bay. Experience alone has provided the following working formula for supervisors to use when computing required storage space for cross-country operations.

$$\text{STORAGE SPACE REQUIRED} = \frac{\text{DURATION OF TDY} \times \text{DISTANCE OF DEPLOYMENT}}{\text{AMOUNT OF SUPERVISION}}$$

Astute mathematicians recognize the denominator to be the controlling factor. As the amount of supervision goes down, the storage space required approaches infinity. In fact, with no supervision, the formula can be simplified to the following:

$$\text{STORAGE SPACE REQUIRED} = \text{STORAGE SPACE AVAILABLE} + 5 \text{ cu. ft.}$$

In summary, with no supervision, the second formula will prevail and accidents become inevitable. The extra 5 cubic feet will be found.

I am reminded of a suave F-100 pilot who nonchalantly confided that his coveted Arabic rug was brought home in the cockpit. He described how the crew chief had guided the rolled rug into the cockpit around his arms and legs then back up behind the ejection seat. Startled, I asked if it hadn't interferred with the flight controls. "Only on right hand turns," he replied. ★

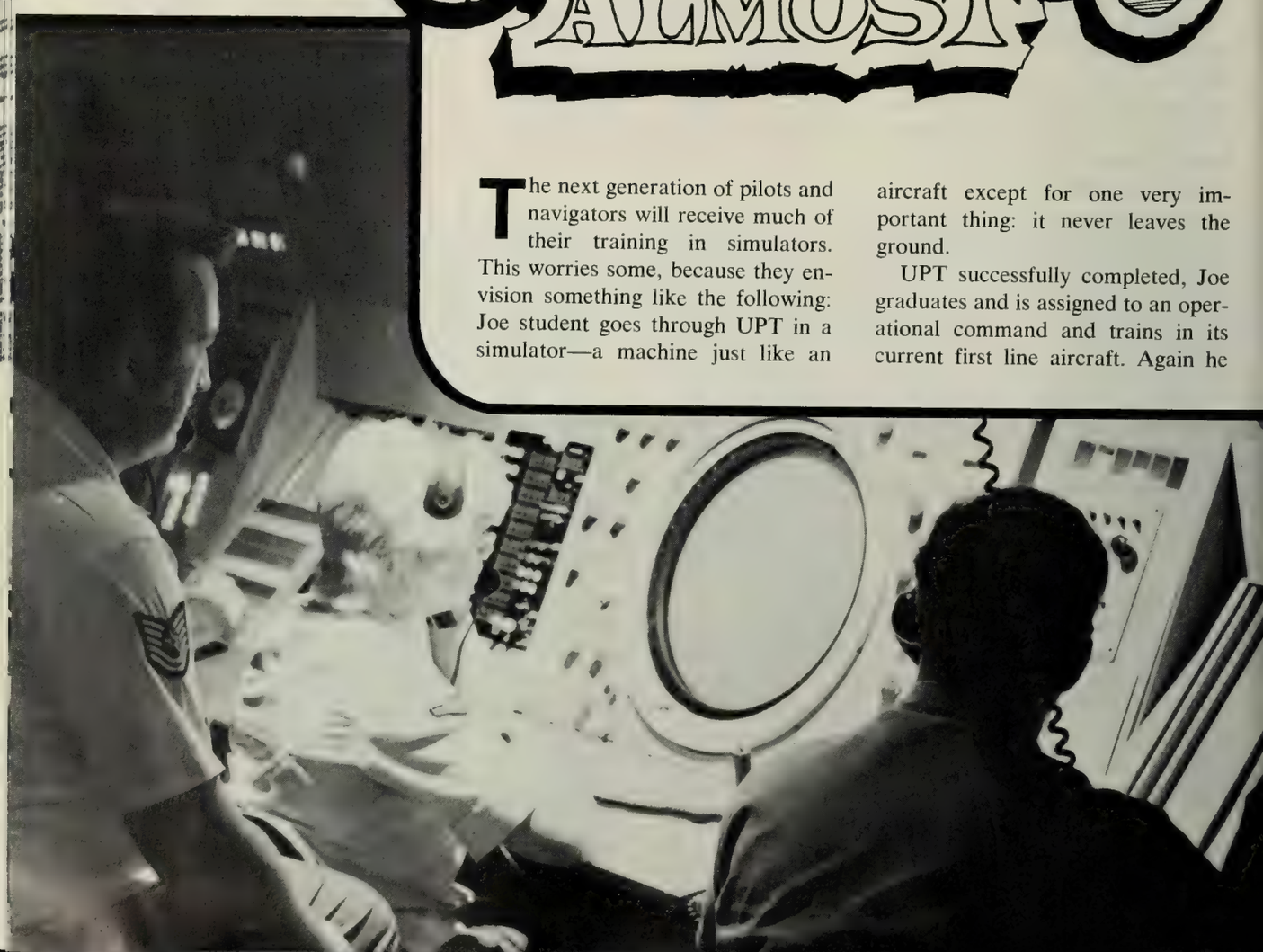


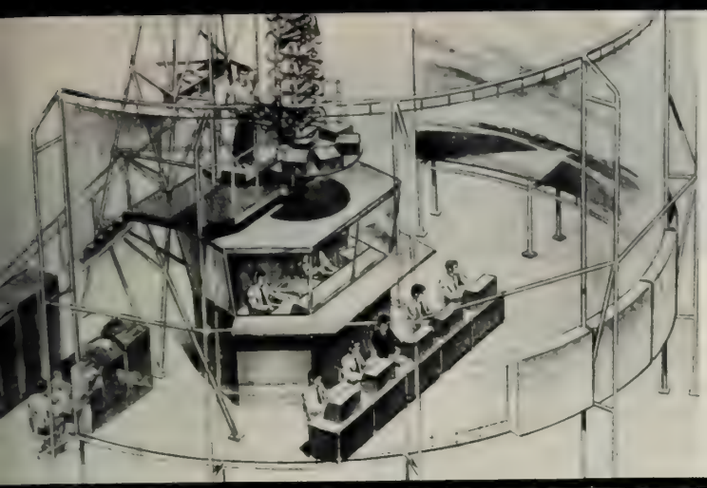
WHEN IT COMES TO SIMULATORS, THOSE THE AIR TRAFFIC CONTROLLERS ARE LEARNING IN ARE . . .

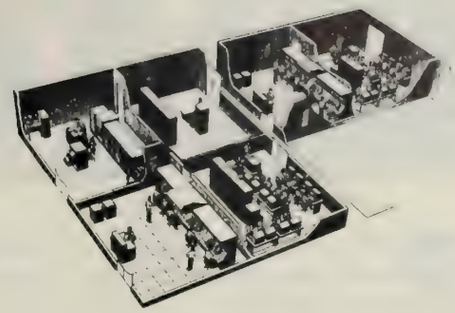
Like The Real Thing ALMOST

The next generation of pilots and navigators will receive much of their training in simulators. This worries some, because they envision something like the following: Joe student goes through UPT in a simulator—a machine just like an aircraft except for one very important thing: it never leaves the ground.

UPT successfully completed, Joe graduates and is assigned to an operational command and trains in its current first line aircraft. Again he







Artist concept of new VFR tower cab simulator, left, radar labs above. Four radar labs operate off two computers 12 hours a day.

never leaves the ground and eventually becomes combat ready, say in a fighter bomber. Then the balloon goes up and Joe finds himself flying combat missions. In unit aircraft? No. Joe controls the aircraft from a bunker miles from the target through television display on the console in front of him. It's just like the real thing, except that Joe is in no danger.

The chances of such a situation developing at some point in the future seems remote. But the fact is that there is going to be a lot more learning through simulation rather than the real thing and not just for pilots. For example, student air traffic controllers these days are learning how to deal with the problems they will face in their profession by the use of computerized simulators that do better—for training—than the real environment.

The AN/GNP T-3 radar target simulator gives the student just about every situation he will ever face, plus an understanding of what it's like on the other side of the scope. Students can "fly" 12 aircraft targets manually; the simulator can supply another 30. The T-3 can simulate ECM and radar beacons for aircraft identification as well as weather patterns, wind conditions, the use of circular polarization and moving target indicator, which is used to reduce the normal ground clutter at most facilities. Airways, navaids and fixes are depicted.

Another important feature is instant replay by which the instructor can rerun up to 10 minutes of a student's performance, a valuable teaching tool that helps the student see the reactions of the target to his instructions.

The Air Force also has coming soon a simulator that will train tower controllers in controlling aircraft under VFR conditions. It consists of a tower cab mockup encircled to 210 degrees by a cylindrical screen. Film projectors provide the VFR environment, showing buildings, runways, navaids and even moving targets such as aircraft and ground vehicles.

Special effects include night operations, clouds, rain, and fog. Students can operate airport lighting and, in general, experience the job of a tower controller in a realistic environment.

The T-3 is currently in use at Keesler AFB in the Air Traffic Control Operator Course. The VFR simulator is scheduled for delivery to Keesler this summer.

What does the future hold in simulation? Consider this. An aircrew flies a complete mission, in a simulator. They take off, fly the mission and return to land all under the control of people operating other simulators. After the mission, Maintenance clears the squawks on the aircraft. Yep, by computerized simulation. Over and out. ★





THE IFC APPROACH

Pilots are aware that in order to fly and successfully land from most non-precision approaches, they should descend to the published Minimum Descent Altitude (MDA) and begin a visual descent (assuming the runway environment is in sight and a safe landing can be made) prior to the missed approach point. Many pilots, however, do not consider the position from which a visual descent should be initiated. This month's article will discuss a technique for estimating the location of this position. Let's call it a Visual Descent Point (VDP).

What is the value of a VDP? First, it provides a point from which a safe transition to a visual approach and landing can be made using the descent gradient for your aircraft. Second, the use of a VDP will assist in avoiding a premature descent from the MDA and a subsequently flat and possibly dangerous approach. Finally, it forces us to think consciously about where the Missed Approach Point (MAP) is in relation to the runway threshold. For example, the approach in Figure 2 will place you 482 feet directly above the threshold at the MAP of a runway only 6003 feet long.

Before we take a look at the steps involved, one point needs to be made. Descent gradients may be expressed in either degrees or feet per mile. For instance, a 3° descent gradient may also be expressed as approximately 300 feet per mile (altitude to lose per mile).

Assume we have been cleared for the TACAN Rwy 12 approach in Figure 1.

Our problem now is to locate the VDP. To define the VDP we should accomplish the following five steps:

STEP 1: DETERMINE THE VISUAL DESCENT GRADIENT TO LANDING.

In other words, what gradient do we normally use for visual approaches? Since this may vary for different types of aircraft, let's use 2.5° gradient as an example.

STEP 2. DETERMINE HEIGHT ABOVE TOUCHDOWN (HAT). From the minima block we see that the MDA is 365 feet above the runway.

STEP 3. DETERMINE THE VISUAL DESCENT POINT. The question we should ask here is, "at 365 feet above the runway, how far from the runway should we be when we start a visual descent using a 2.5° gradient?" To do this we'll use the information from Steps 1 and 2. Divide the HAT by (Visual gradient in degrees X 100) in order to determine the VDP in miles from the end of the runway.

$$\frac{365}{2.5 \times 100} = \text{approximately } 1.5$$

miles *from the end of the runway*. Caution must be used as the distance we calculated is measured *from the runway* and *not* necessarily the DME reading that will be displayed at the VDP.

STEP 4. DETERMINE COCKPIT INDICATION OF THE VDP. Now we must convert the VDP found in Step 3 into a DME reading. From the aerodrome sketch we can estimate that the approach end

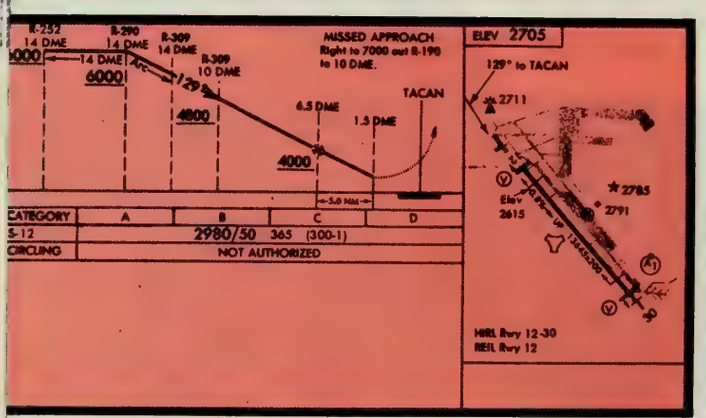
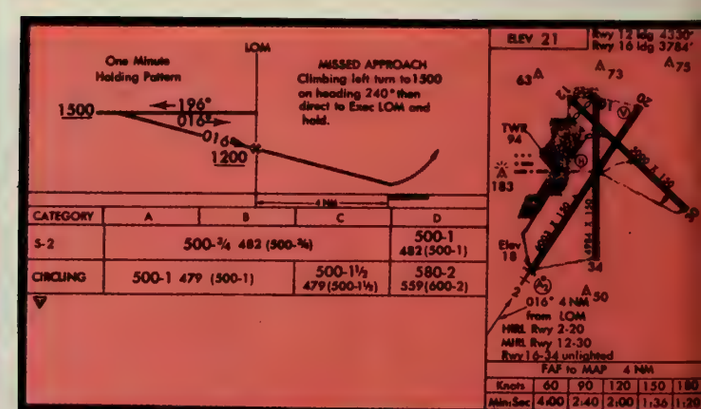


FIG. 1

FIG. 2



of RWY 12 is approximately 1 mile from the TACAN. To this add the 1.5 miles from Step 3. The result is 2.5 DME. Therefore, starting a descent at 2.5 DME and using a 2.5° gradient will get us to the approach end of the runway. Make sure, however, that conversions to DME are done correctly.

STEP 5. DETERMINE THE GRADIENT FROM THE FAF TO VDP. Now we should figure a gradient that will get us to the MDA at or before the VDP. We must descend approximately 1000 feet (4000-2980) in 4 miles (6.5 - 2.5) or about 250 feet per mile ($\frac{1000}{4}$). That means we must use at least a 2.5° gradient from the Final Approach Fix (FAF) in order to reach the VDP at the published MDA.

Now let's look at an approach without DME. Before you read any farther, try to figure a VDP for the NDB RWY 2 depicted in Figure 2 using a 2.5° visual descent gradient. Let's see how you did.

STEP 1. We'll use a visual gradient of 2.5°.

STEP 2. HAT is 482 feet.

STEP 3. The VDP will be approximately 2 miles ($\frac{482}{2.5 \times 100}$) from the approach end of RWY 2.

STEP 4. Our problem varies from the first example. We should ask, "How far is the VDP from the FAF?" Since we must be 2 miles from the approach end of the runway, we can see from the profile view that it will require 2 miles from the FAF to the VDP. The only means we have to identify the VDP for this approach is timing. If our ground speed were 120 knots, our timing to the missed approach point would be 2 minutes and to the VDP, one minute. Therefore, one minute after the FAF we should be at the MDA.

STEP 5. In 2 miles we must descend 700 feet (1200 - 500). This will require a 350 foot per mile ($\frac{700}{2}$) descent gradient (or a 3.5° gradient).

One more important point. If this technique is to be used, enough time should be allotted for the required calculations. Just prior to the FAF or halfway through a penetration is not the time to compute a VDP. The ideal time and place is during mission planning at base operations.

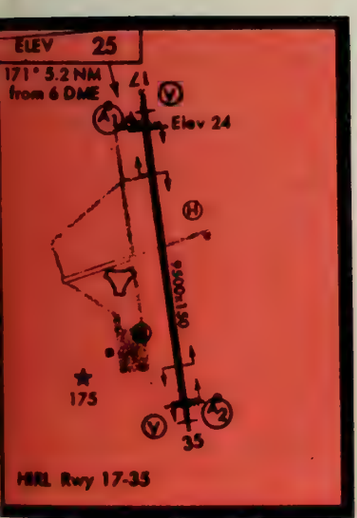
In approximately one year, VDPs will be portrayed on approaches, thus eliminating the need for the pilot to perform some of these computations. Until then, you may find this technique valuable.

INTERPRETATION OF ARRESTING SYSTEMS

Recent discussions with several pilots have revealed that the listing of Jet Barrier/Arresting Gear (J-BAR/A-GEAR) information in the DOD FLIP IFR Supplement is subject to misinterpretation. This area may best be clarified by referring to the following excerpts from the IFR Supplement and Instrument Approach Procedures (Terminal).

Consider runways 17 and 35 in the aerodrome sketch (Figure 3).

FIG. 3



MYRTLE BEACH, SOUTH CAROLINA
MYRTLE BEACH AFB

FIG. 4

AERODROME/FACILITY DIRECTORY 293

◆ **MYRTLE BEACH AFB.** SC 33°41'N 78°56'W GMT-5(-4DT) H-4, L-20-27
AF 25 BL4, 6, 7, 8, 9 H95 (ASP/CON) (S50, T110, TT220, TDT650) ① (KMYR)
JASU- 1(MA-1A), 1(MA-2) 1(MD-3M), 1(MC-1A), 1(MC-2A)
FUEL- J4, SP, O-128-133-148 SOAP PRESAIR LPOX LOX
J-BAR/A-GEAR

RWY 17	MA-1A/BAK-9(B) ②	BAK-12(B)	BAK-12(B)	BAK-9(B)/MA-1A ②	RWY 35
	(150' OVRN)	(50' OVRN)	(1450')	(1300')	(50' OVRN) (155' OVRN)

EXPLOSIVES CAPABILITY- A/1/1/1-B/1/20/20/20/PPR 7144
AERODROME REMARKS- CAUTION-Flush mounted strobe and apch lgt within 150' of BAK-9 pendant may deflect arresting hook. CAUTION-Copter trng area lctd E of the apch end of rwy 17 with copter opr 500' and below. CAUTION-Conway-Horry Co Arpt VFR tfc pat vcnty downwind leg of Radar Apch rwy 17. Overhead tfc pat 1700'. Large birds vcnty of A/D dur migratory season. Opr 1200-0400Z (DT 1100-0300Z). Dur non opr hr ctc Wg comd post for emerg afld lgt. A/D is clsd 1st Sat of ea month fr 1200-1700Z (DT 1100-1600Z) for preventive maint, exc for sked Civ Air Carriers. Acft carrying dangerous cargo will relay rqr info thru PTD prior to ldg. Unable to handle C-5 acft with dangerous cargo. Use extreme caution for unctl VFR tfc freq violating lcl airspace. Tran ldg copter apch fr E or W below 500'. IFR dep and arr rte over water, floatation gear advs. Over-water survival eqpt not avbl for issue. Tran alert svc avbl A/D opr hr only. Tran acft can exp arr and dep delays dur periods of stu trng Mon-Fri to incl rstd to one apch and ldg. ① PPR for T and TT acft with higher GWT. ② 20 min prior ntc rqr.

Continued Next Page

J-BAR/A-GEAR equipment is installed on these runways as indicated by the symbols ⌐ and ⋮ . In order to determine the type, exact location, and usability of the arresting systems, refer to the IFR Supplement (Figure 4).

The arresting gear is depicted as it is located on the runway and should be read left to right for RWY 17 or right to left for RWY 35. Proper interpretation of the arresting systems on RWY 17 is as follows: The MA-1A (indicated by ⋮ in the aerodrome sketch) is a web barrier located in the overrun 150 feet from the approach end of RWY 17. This is indicated by "(150' OVRN)" directly below MA-1A. It is not used for approach end engagements. The BAK-9(B), indicated by ⌐ in the aerodrome sketch, is also located in the overrun, 50 feet from the runway surface. The BAK-9 is bi-directional, as indicated by the arrows in the aerodrome sketch and by the symbol "(B)" in the IFR Supplement. The BAK-12(B) is located on the runway surface 1450 feet from the approach end. If you understand the discussion to this point, you should be able to interpret the remaining system without any problem. Further barrier information, such as terminology and operational characteristics, can be found in the front of the IFR Supplement.

CORRECTION

Our December 1975 article contained an error. In the center column, about a quarter of the way down, the sentences should read, "That is, passing FL 250 you have 15,000 feet to lose, $25-10=15\times2=30$ *NM*, $25+30=55$ *DME*. If you are closer than *55 DME*, increase rate of descent and if you're at say *65 DME*, decrease rate of descent."

Thanks to those of you who brought the error to our attention. It is rewarding to know that you are reading the articles with an inquisitive eye. ★



Don't Let Your Wingman Down

(without oxygen, that is)

CAPTAIN THOMAS B. LAIRD
ATC Aerospace Physiology Training Aids Center
Randolph AFB, Texas

A recent hypoxia incident involving a student pilot brings to mind an important fact. Oxygen regulators occasionally *do* fail, either completely or partially. It happened at least six times in 1975.

Take for example a Monday morning when you realize after takeoff that your T-38 isn't giving advertised pressurization. So you elect to press on and stay below FL 250. Combine this with a faulty regulator and a student who gets his personal hypoxia symptom(s) but doesn't do anything about it. That's another fact; people do occasionally fail to use their training. And refamiliarization with your hypoxia symptoms is one reason, perhaps the biggest one, why we give you a chamber flight every 3 years.

Back to the hypoxic student. Now add a wingman who sees the student making seemingly purposeless movements (continuously cycling his helmet visors, putting his head down, then repeating the action several times), but who doesn't even tactfully ask if he feels O.K.

Now the good news. The "hypoxia" aircraft was a dual bird. After the flight, the student raised the question about what might have happened had he been solo. Good thinking!

Now for you wingmen; remember TIME OF USEFUL CONSCIOUSNESS? Don't hesitate. Later on the other guy might still be conscious, but not usefully, so he can't make his hands do what you're telling him needs to be done—like gangloading his regulator, and initiating a descent. Awareness by the other formation crewmembers of objective hypoxia signs, such as those displayed by the student above, or slurred speech, sloppy flying, and belligerence, should cue a life-saving query—one that will come in time for corrective action. ★

Did I Do Something Wrong, Coach?



Wg Cdr MARK PERRETT, RAAF
Directorate of Aerospace Safety

A T-39 crew attempted a battery start at a base of another service after the ground power unit failed to power the starter. The first start attempt was discontinued when the starter button popped out. A second start attempt was made after a one minute wait, with battery voltage indicating 21. A ten-knot tailwind was blowing. The second start attempt was normal until the rpm hung at 30 percent. EGT rose to 630-700 degrees and stayed there for about 5 seconds. The throttle was selected OFF. The engine was changed following a hot start inspection, and turbine components required replacement.

T-39's often visit bases whose transient personnel are not very familiar with the aircraft. (In a recent incident, the civilian contractor started gravity refueling a T-39 through the sextant port.) Maybe people are reluctant to admit unfamiliarity with such an apparently simple aircraft. In any case, the aircrew must be aware that such mishandling could occur at any time. Naturally, also, the aircrew must be thoroughly familiar with the requirements for ground handling—refueling procedures, AGE requirements and starting procedures.

When external power is not available, battery starts have to be made —that's a fact. But first, make sure that external power really is not available. Ensure that transient crews are clear on the type of starting power you need. The Navy, for instance, has different names for similar AGE. Ask yourself if you are allowing the pressure of priority passengers or delay times to influence your decision.

If, ultimately, you decide a battery start is necessary, consider the following points:

- TO 1T-39A-1 states that battery voltage should be a minimum of 21 for start. You know, and I know, that the closer the voltage is to 21, the less the chance of a good start.
- Any sort of a tailwind will inhibit the start, and if any other starting parameter is approached a tailwind may be the last straw.
- If you introduce fuel and ignition at 8% rpm vice 10%, your chances of a hung start are substantially increased.
- An unsuccessful first attempt could deplete the battery sufficiently to prevent starting, could also cause significant internal heating of the batteries, and induce thermal runaway.

The values of 30 seconds with motoring or 2 minutes draining are absolute minima to eliminate excessive fuel following a stopped start. Have that engine checked for excess fuel even after those precautions, to ensure against a hot start.

- Finally, monitor all available engine instruments particularly the combination of rpm, fuel flow and EGT. At the slightest indication of a hang up, stop the start.

There are many pressures on T-39 pilots when operating on administrative support flights. It is nice to think of yourself as a professional who gets the job done. It is, however, much easier to live down a delayed start than an unnecessary engine change. ★



FROM WHENCE WE CAME



Those Days Of The LEATHER HELMET

MSGT DAVE SYLVA
63 MAW, Norton AFB CA

Minds of men fashioned a crate of thunder

Sent it high, into the blue

Hands of men, blasted the skies asunder

How they lived, God only knew

Souls of men, dreaming of skies to conquer

Gave us wings ever to soar

In echelon, we'll carry on

And nothing will stop the Army Air Corps

From The Army Air Corps Song
By Robert Crawford

What made it so damned ironic, was the fact that the newspapers were carrying both stories at the same time. The Disarmament Conference was getting big play. At the same time, in the same issues, there were smaller articles that spoke of the tests being conducted off the Virginia Cape to study the effects of aerial bombs on surface vessels. Very few people seemed to sense any connection or contradiction in the two stories.

If our press was not terribly impressed with the tests, the impact of the bombs on the *Ostfriedland* were not lost to the rest of the world. In a public statement, the Japanese military attache said, "Very great experiment. Profoundly exciting. Our people will cheer your great

LY SUN, FRIDAY, JULY 22, 1921

So Far the Weeks Family Seems To Be the First To Get Its House Cleaning Done



AIR BOMBS SINK ARMORED SHIP

Projectiles Weighing Ton Dropped From Planes on Ostfriesland

(By Associated Press Leased Wire)

ON BOARD THE DESTROYER LEARY, Enroute to Norfolk, Va., July 21.—The ability of the airplane to destroy the capital ship, was demonstrated to the satisfaction of the War Department officials today off the Virginia capes.

Army bombers, launching projectiles weighing one ton, sank the former German battleship Ostfriesland, a 23,000 ton heavily armored ship in exactly 35 minutes after they opened their attack at 12:15 p. m. from an altitude of approximately 1,700 feet. Two bombs which landed overboard within a few yards of the port quarter gave the ship her death blows.

Seven of the one ton m[illegible] many ar[illegible]

Ironically, while front page stories announced tests of aircraft vs ships, the disarmament conference was getting big play and cartoons on the editorial page marked the dismantling of the War Department.



Page 14, first aerial refueling with Wesley May transferring from one plane to other with gas can on his back. Left, crew of the Question Mark (see story) Maj Carl Spatz, Maj Ira Eaker, Lt H. A. Halverson, Lt E. R. Quesada, Sgt Roy C. Hooe.

Mitchell (Billy Mitchell) and you may be sure, will study his experiments. There is much to learn here. It would be gravely embarrassing to the American people if the ideas of your General Mitchell were more appreciated in Japan than in the United States . . . but then, gratitude is not one of the attributes of democracy."

It was July 1921 and the first great World War had been over less than three years. The American people, sickened by the deceit of European power politics and by the carnage on the battlefields of France, had withdrawn behind the oceans. With friendly Canada and Mexico to the North and South, there was nothing to fear from those quarters. The British Navy guarded the Atlantic. Our great Pacific Fleet guarded the Western border. We were safe from attack and would not allow ourselves to become involved in another foreign war. One senator summed it up for the people; "I would adhere closely to the advice of Washington—no entangling foreign alliances, expressed or implied."

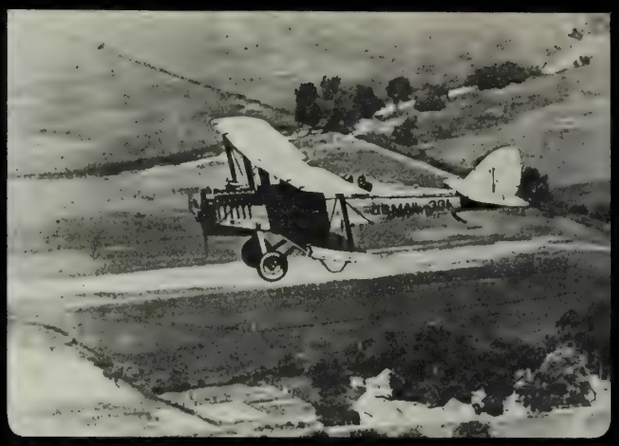
The military had been demobilized. The Air Service was slashed by 95 percent, from 200,000 men down to 10,000. The appropriations for the Air Service were cut as badly.

America, the inventor of the airplane, had fought the war in British, French and Italian airplanes. The only American built combat plane was the British designed De Haviland 4 which Mitchell branded "the flaming coffin." At that, of the 3,000 DH-4s produced in America, only 169 reached France. Now with the war behind them, the Air Service could look ahead to more belt tightening and less support for new equipment. After all, the airplane was an attack weapon and America wasn't going to attack anyone. Again, a single congressman's comment summed up the overall feeling; "What is the Air Service complaining about? They have a plane. Let them take turns flying it."

The unofficial motto of today's Air Force; "To Fly and Fight," would have suited the Air Service equally well, or better. For fight they did. They fought for recognition, for appropriations, for newer and better airplanes, for indepen-



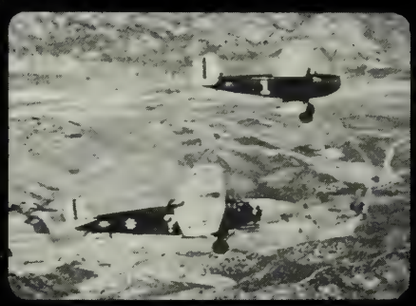
Col Wm (Billy) Mitchell and counsel at his famous court martial.



A DH-4B transcontinental air mail plane. Sonic booms were yet to come.



An early refueling experiment with DH-4Bs. Lts Sowell H. Smith and P. Richter were pilots.



1929—world endurance record flight. Trimotor Fokker "Question Mark" refueling over Burbank, California.



Lt James Doolittle is congratulated by Maj Shepler Fitzgerald at end of one-stop coast-coast flight, September 11, 1922; Pablo Beach, Florida, to Rockwell Field, California.

dence from the ground minded Army's General Staff, and for simple survival of the flyers.

Bases around the world are named after the men who died in the crashes of their obsolete and unsafe machines; Lt Col Horace M. Hickam, Major Harry Geiger, Colonel Les MacDill, Captain Ernie Harmon, Colonel Bill McChord and Lt Gene H. Barksdale.

The times between the wars, the twenties and thirties, were some of the darkest days in the story of American airpower. They saw the Mitchell courts-martial and the exile of the advocates of flying to non-flying posts. The same times saw the Army's ill-starred attempt to fly the airmail and recorded the casualties that followed.

But if the times were bad, they were some of our best years as well, because that is the Air Force story. A story of triumph and defeat, sacrifice and apathy, faith and betrayal.

Looking back at those days, we see some of the giant steps that were taken. By themselves, they were wonderful accomplishments but when viewed in the light of struggle that was going on for simple survival the successes become fantastic.

Like Wesley May hanging onto the wing strut of a *Lincoln Standard* with a five gallon gas can strapped on his back. His pilot, Frank Hawks, held the bird straight and level as Earl Daugherty maneuvered his *Curtis JN-4 "Jenny"* in above them. The can didn't weigh much, only 35 pounds or so, but it was awkward and one misstep would have ruined May's day. As the *Jenny* slid in closer, May let go of his grip on the strut and grabbed for the Jenny's wing skid. Trying not to look down he clambered aboard, worked his way over to the fuselage taking the full blast of the prop wash in the face, poured the gas into the *Jenny's* tank.

A year and a half later in June, 1923, two DH-4s flown by Lowell Smith and John Richter transferred fuel through a pipeline while flying over San Diego. The two Air Service lieutenants improved on May's technique and made air to air refueling a fact.

A little more than five years later, another Air Service crew, Tooey Spaatz, Ira Eaker, Pete Quesada, Harry Halverson and Roy Hooe, set a still remarkable record when they kept a *Fokker C-2* airborne more than six days. Flying over Los Angeles, the *Question Mark* took on food, mail, spare parts and over 5,000 gallons of gas.

Kelly and Mcready, Fokker T-2, which they non-stop from New York to San Diego in hours.



T-2 equipped for blind flying. Right, Maj A. F. Hegenberger, conceived system. First flight 1932, first hooded solo landing on May 9, 1932.







Douglas D-WC World Cruisers which Air Service crews flew around world in 1924. Team set many new records.



Douglas B-19 bomber at March Field, California, in June 1941. Biggest aircraft of its day, it became research craft.

While AAR was being tried and tested, other strides were being taken. A very young Lieutenant Jimmy Doolittle crossed the continent in less than a day averaging 100 mph in his DH-4. Eight months later, two Air Service types, Lts Kelly and Macready earned the DFC and the Mackay trophy for repeating the performance—but nonstop this time. Their *Fokker T-2* made it from New York to San Diego in 26 hours. Less than a year later, in 1924, four Air Service planes, Douglas *"World Cruisers,"* started out on a globe circling flight. Only two of them made it and it took them 175 days for the two to finish, but considering transient alert facilities in outer Mongolia, it wasn't too shabby. The flying time was only 363 hours. While they were at it, they also set a new record, the first trans-Pacific flight and the first westbound Atlantic run.

Doolittle's name keeps coming up when we look back. In addition to his now famous land plane speed records, he also flew the first successful outside loop in 1927. Other pilots had flown the loop, but had failed to land successfully because of wing separation. Two years later, Lt Doolittle made the first all-blind flight at Mitchell Field. He had the stick but there was a guy in back who could see. Three years later Captain A. F. Hegenberger tried it solo and made it with no one to pull him out at the last minute. By 1932, an Air Service Captain, C. J. Crane, had invented an automatic landing system. Captain George Holloman tested it and made the first "hands-off" landing in history.

The list goes on and on: Speed records, endurance flights, new systems, new techniques and new planes. The time between the wars saw the change from the old, slow pursuit planes to the sleek forerunners of the modern fighter; the *Lightning,* the *Aircobra* and the *Warhawk.* It saw the change from the open cockpit long range bombers (400 miles) to the truly long range heavy bombardment *Fortress,* the *Liberator* and the *Superfortress.*

It must have been a frustrating time for the men who knew what the airplane was going to do to the future of man. It was the time that strained men's loyalty to their beliefs to the breaking point. Luckily for us, the men of the leather helmet, goggles and scarf era were pretty sturdy stock. They stayed with it in spite of the ignorance, indifference and hostility they faced. They were a pretty special breed. ★



TWO PERCEPTIONS

MAJOR THOMAS L. SUTTON
463 TAW, Dyess AFB TX

Who was to blame for the near accident? Maintenance? Or the pilot? Or did the both conspire to nearly cost the pilot his life?

The sparse jungle and grassland rolled away to the dim horizon in every direction. It all looked silent. Nothing moved. The bright sunlight betrayed the apparent peace as it flickered like thousands of muzzle flashes from the stagnant pools living partially concealed in the foliage below. Lightning's voice whispered raspily into my headset jarring me from my musing. I could hear explosions of mortar shells and snapping of small arms fire behind his voice.

"Walt, Walt, this is Lightning," he whispered. We've got 'em pinpointed. Lay the CBU right along the creekbed between the two big, dead trees. And be careful. They're shooting at you too."

"Roger Lightning, get your heads down."

I rolled my O-1 into a steep diving turn, lined the nose up on the nearest tree, and squeezed off a white phosphorous rocket. Then I cleared the flight of F-4s in hot with CBU.

"Walt! Right on target," Lightning screamed.

A few passes later we pulled off as Lightning promised a good BDA. I told him that I was out of rockets and would go get some more, if he could spare me.

"Go ahead, Walt. Just hurry back. There's no telling what's down in that creekbed."

I cobbed the power to my aerospace vehicle and roared toward home base at 70 knots max airspeed. Even though the firing had stopped back there, I knew that Lightning might need my help again soon so I wanted to hurry. I pointed my bird right toward the center of the 2500 foot red dirt airstrip as it came into view and relayed my requirements for a quick turnaround.

In order to shave off a few extra minutes I decided to eliminate the normal box pattern. I flew across the approach end of the runway outbound at a thirty degree angle while checking my fuel, carb heat, mixture, and prop setting. I also noticed the covey of VNAF and US Army pilots standing around a VNAF O-1 that had recently ground looped half way down the runway. A few fellow FACs were there too. What an audience. This one had to be good. After clearing the final approach course, I rolled into a modified split-S to a very steep final approach.

I began to apply back pressure on the stick to slow my screaming descent, but the immediate sensation was that my nose was going down faster than ever. It's the same sensation you get when you apply the brakes at an icy intersection and seem to suddenly leap ahead into the cross traffic.

My first thought was that I had runaway nose down electric trim. My heart jumped into my throat and my stomach began burning a new hole. In less than a second I had convinced myself that there was no such thing as runaway electrical trim on an aircraft that was purportedly built by the Wright Brothers. The fact remained, however, that I was still diving straight into the ground. The stick would not come back.

Not choosing to consider all of the alternatives, I did what all cool, level-headed pilots would have done. I grabbed the stick with both hands and yanked with all my strength. The stick came begrudgingly back into my lap and the tail of the bird rotated down rapidly. The timing was perfect. The O-1 touched down in a precise three point landing. The only deficiency was that the rate of descent was in the vicinity of infinity.

Riding the Cessna spring gear down until the bottom of the fuselage was in the dirt, I immediately found myself being propelled back into the air by the force of those mighty springs. Taking advantage of the situation, I rammed the throttle forward and found myself remaining airborne above stall speed. That was small satisfaction, for the rudders were jerking angrily back and forth and the tail was right in synch with them. I was not sure that the tail was going to stay with me. The burning in my stomach turned to lead.

I continued to climb out making very small control movements. At a safe altitude I inspected the damage and found that my tail wheel was broken off and was hanging from the aircraft by one bungee cord. As it flailed back and forth, it dragged the rudder with it causing a wild hula motion. Feeling a bit relieved, I performed a few approach and landing stalls and was pleased that the elevator seemed to work all right. After some coordination with the guys in the radio jeep, I made an uneventful wheels landing and came to a stop dragging my tail behind me.

I was met by a huge crowd of jeering troops. I was appalled. They were chiding me for a very inept landing. They would not believe that I had actually had control problems. The crew chief casually inspected the bird and pronounced it in excellent shape except for a missing tail wheel and a few wrinkles in the skin. I began to wonder myself if I had really had a control problem.

Then I noticed our chief mechanic crawling out of the tail cone from behind the radio rack. His jaw was set in anger and his right hand clutched a pair of pliers. My anger grew as I learned that the pliers had apparently been left in the tail cone after the last periodic inspection and that they had vi-

TWO PERCEPTIONS

brated into a position where they were jamming the elevator control cable. My anger subsided, however, as I noticed that my image had been spared and that I was being congratulated for having survived another of the maintenance booby traps so skillfully laid for unwary pilots. Maintenance had tried to kill me and had failed. For seven years I have thought that this was the case, but now I have a new perception.

* * *

It was getting late in the evening. Airman Hotshot was wrapping up his inspection. Two thoughts were jockeying for position in his forebrain.

Why couldn't I be down at Cam Rahn crewin' a Phantom? Now there is something I could really get my hands on. Oh, oh, I've got to get to the service club. The USO show tonight is real American.

A few more turns on the safety wire and he says, "There, it's all safetied. Now just button it up and I'll get out of here. Sarge, this hunk of junk is finished."

"Okay, Hotshot. Look okay?"

"Sure it's okay. What can go wrong with a powered kite?"

"Not much I guess. Get on down to the club. I'll sign it off."

Closing up his tool box, Hotshot says, "Funny, thought I had my pliers here somewhere. Oh well, they'll turn up."

"Wait a minute, Hotshot. You know it's dangerous to leave tools unaccounted for."

"Oh look, Sarge. If we had F-4s here, we'd be worried, right? But this engine can't swallow nothin'. The electric and hydraulic systems are impossible to find with the naked eye. These birds are just chewing gum and bailing wire. What can happen even if the pliers are in it, which I doubt? What can go wrong? That tool accountability is just for real airplanes."

"Well, I guess you're right. Besides, we'll find them in the morning."

As Hotshot went out the door the Sarge thought for a moment about looking for the pliers, but then, *Hotshot's right. What can go wrong? Besides I gotta get to the club too. Can't wait to see a real round eye.*

Careless? Yes. Unprofessional? Of course. Normal? I hope not. An accident cause? Not necessarily. Only if certain other events occur in a proper sequence will an accident occur. However, if the pliers had been accounted for, they would not have become a necessary link in a future chain of events.

* * *

The Bird dog was picked up early the next morning and flown back to the forward site. Two missions were flown uneventfully. Ten hours were logged. Then on another normal mission, troops in contact.

"I'm out of rockets, Lightning. If you can hold on I'll get some more."

"Go ahead, Walt. Just hurry back. There's no telling what's down in that creekbed."

I was a mission hacker. I was proud of getting the job done no matter what. It was great to sit at the bar and have the Grunts buy drinks and with great oratory extol the virtues of any guy who would sit in a kite right above the fighting with absolutely no logs to hide behind.

I've got an image to defend here.

Those guys who bend their airplanes just don't know how to fly and fight like I do. Besides, we gotta help the Grunts.

Typical hotrock pilot reasoning, isn't it? The kind of mission hacker attitude your flight commander likes to hear.

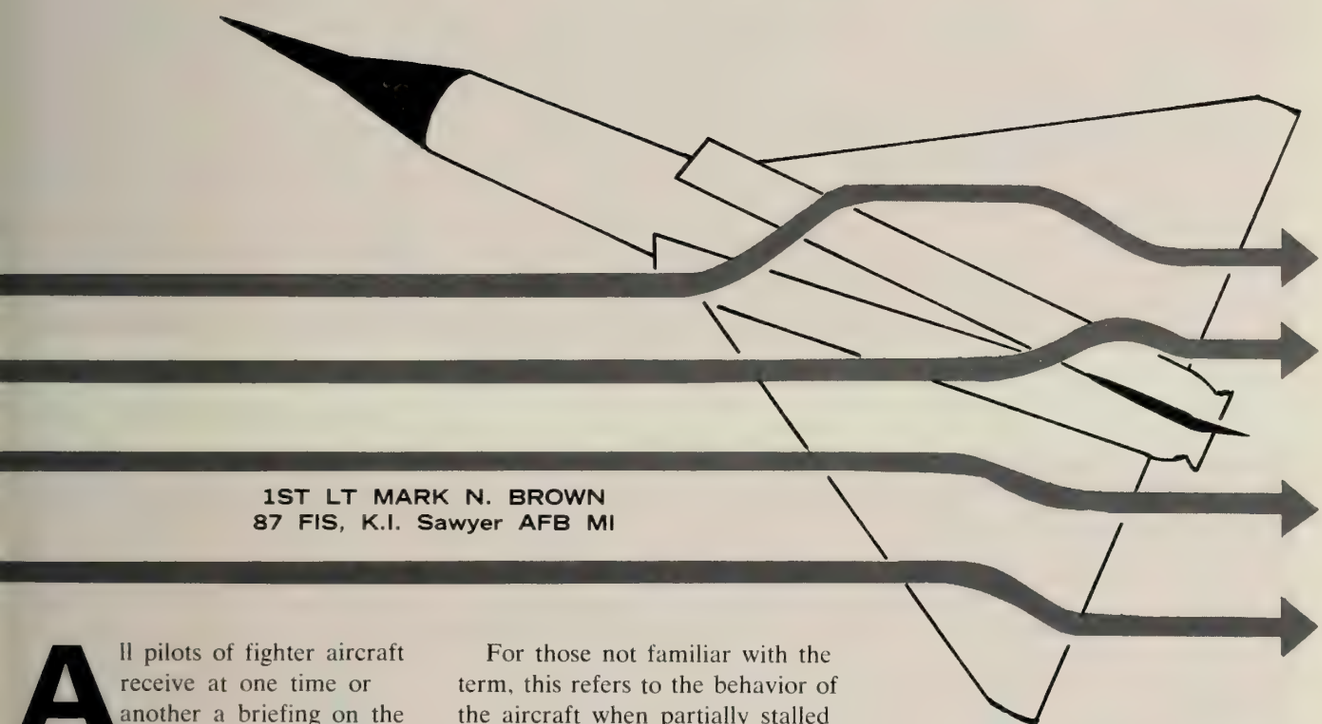
Aha, look at that VNAF O-1. Ground looped right in the runway. Those guys need a lesson in how the pros do it. I'll just bend it around really steep here and show 'em how it's done.

A few more links are pounded solidly into a chain that is now long enough to hang something on. Self-control? No. Overconfidence? Yes. Professional? No.

Was it all predestined? Of course not. The pliers could have stayed in the tail cone for weeks. Hotshot could have found them on the next periodic inspection and no one would have been the wiser. The mission could have been completed, but the pilot was busy explaining to the squadron commander how inept the maintenance men were.

Thinking back over my flying career, I suspect that there have been many events lurking behind the 4500 hours that I have spent in the air without an accident. Events that never got welded into a chain to hang me on another limb. When an accident has been prevented by cool professionalism, no one ever knows. We can't keep statistics on the ones that never happen. The forging of a chain of events is stopped every day by people doing their job—really doing their job. Those people aren't aware that they have prevented a catastrophe. They just know that they go home each night with the satisfaction that they are really doing a job. They are seeing to it that the organization hacks the mission and at a minimum risk. They are the professional chain breakers and my hat is off to them. ★

A NEW LOOK AT AERODYNAMIC COUPLING



1ST LT MARK N. BROWN
87 FIS, K.I. Sawyer AFB MI

All pilots of fighter aircraft receive at one time or another a briefing on the behavior of their aircraft at high angles of attack. Part of this briefing deals with the effect of flight control inputs with the wings of the aircraft in a partially stalled situation. These briefings explain in detail things like pitch-up, adverse yaw, and rudder reversals, and point out quite clearly why you should never put your aircraft in such an unfriendly situation. Unfortunately, the explanations of why the aircraft will respond in this manner usually leave something to be desired. In one case in particular this is especially evident. That is the explanation for a rudder reversal with positive G loading.

For those not familiar with the term, this refers to the behavior of the aircraft when partially stalled due to positive G loading, followed by the input of rudder. If you have heard this explained before, you undoubtedly followed the instructor's explanation of why things were happening until he got to the point where the aircraft is subjected to a rudder input. Usually, the instructor will flash a diagram, similar to the one in Fig 1, on the wall and tell you that the following snap roll into a spin is caused by aerodynamic coupling. I have yet to meet a person who can simply and understandably explain that diagram. With this in mind, let's take a new look at what's happening to the aircraft in respect to the airflow over the wings and control surfaces.

First, let's look at an F-106 in an unstalled and partially stalled condition as shown in Fig 2. For an unstalled aircraft where the relative wind is straight off the nose, there is only a slight deflection of the airflow over the wing toward the wing tips due to the sweepback of the wing. Now, as the angle of attack is increased until the stall begins we notice that the stall begins first at the wing tips and gradually

FIG. 1

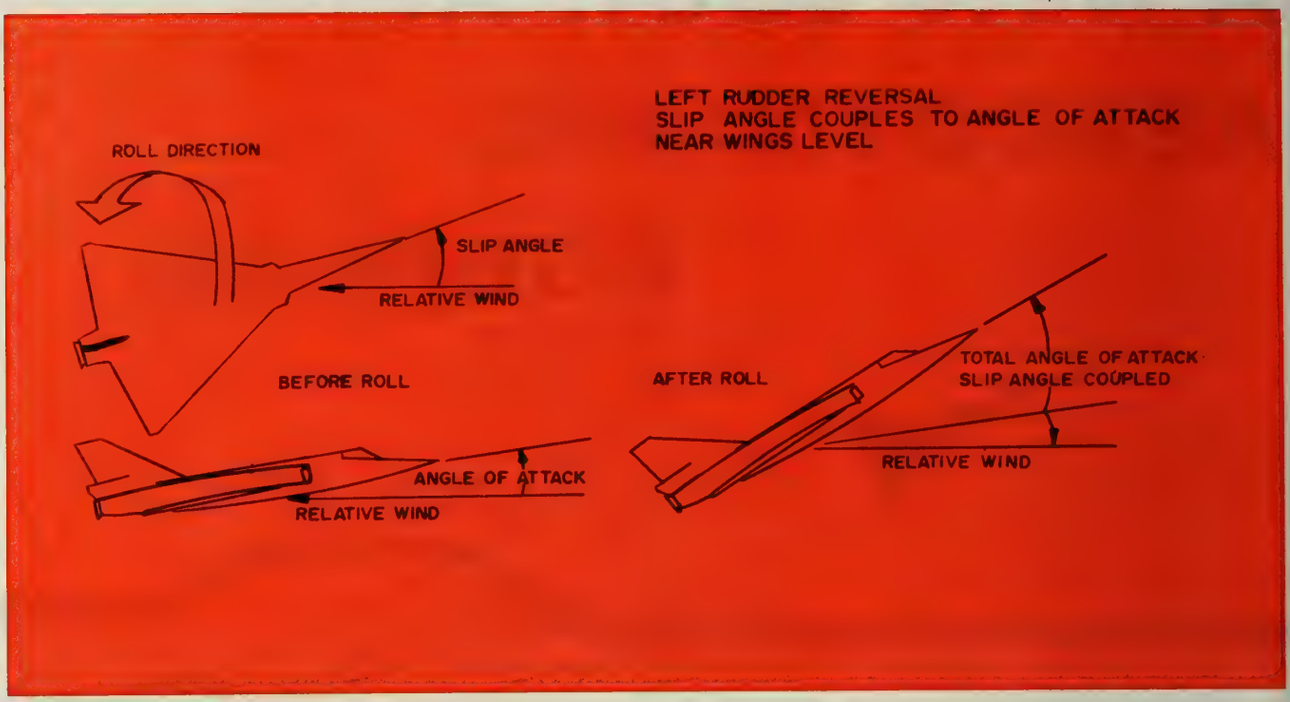
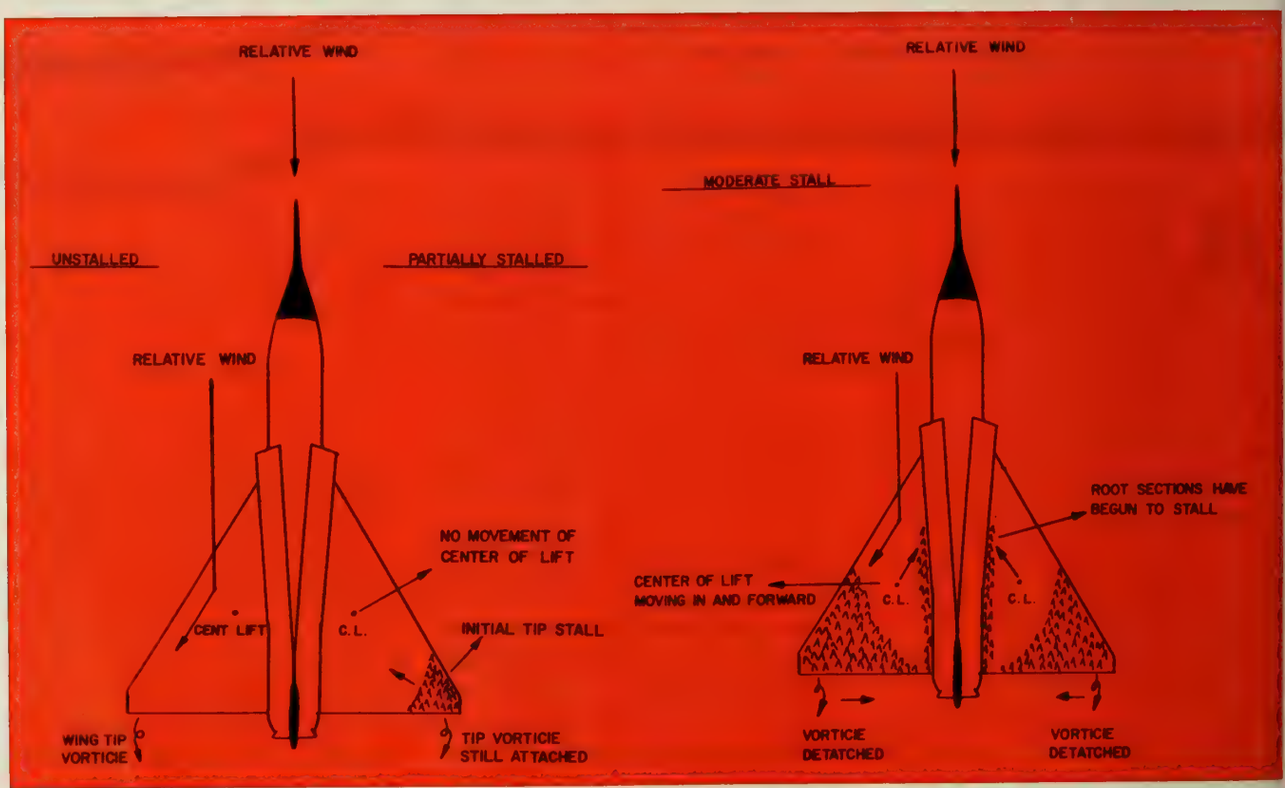


FIG. 2

FIG. 3

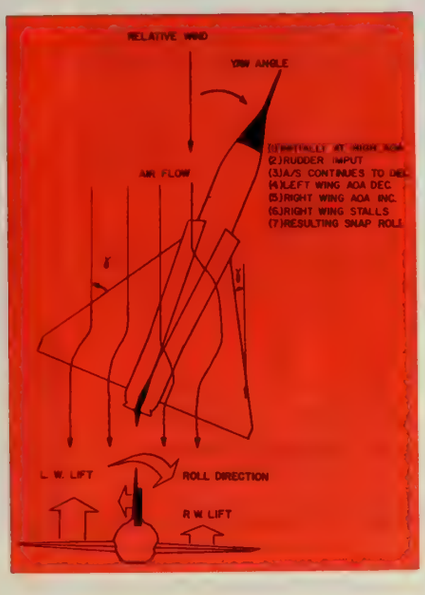


moves in on the wing. At this point the wing tip vortices are still attached to the tips and the center of lift of the wing has not yet moved.

As the AOA is increased farther into the moderate stall area, many things begin to happen at once (see Fig 3). First, the stall which was only at the wing tip has now grown to cover the entire wing tip and most of the trailing edge of the wing. The root of the wing near the fuselage has also begun to stall. Due to the increased area now stalled, the center of lift begins to move forward and in on the wing, beginning what is known as the pitch-up. At the same time the wing tip vortices have now detached from the tips and begun moving in on the wings. The effect on the aircraft of these changes is now noticeable. The increase of stalled wing area has partially blanked out the elevons, setting the stage for adverse yaw from pilot inputs. The stall beginning at the wing root is generating turbulent air which flows along the fuselage and across the bottom portion of the rudder.

Most important is the detachment of the wing tip vortices. They generally detach from each wing tip at slightly different AOA's and move independently of each other in towards the tail. Since they do not move together they cause the aircraft to yaw and roll slightly, back and forth, as the vortices move. It is at this point where the pilot has the tendency to make an elevon input to keep the wings level. The adverse yaw that would result, of course, would only compound the problem. Besides, the pilot knows better so he corrects with rudder. If the stall is not yet moderate and the rudder input is small it may indeed work. However, if the stall is indeed moderate, the pilot has a big surprise coming.

FIG. 4



The input of rudder at this time moves the relative wind from directly off the nose of the aircraft to one side (see Fig 4.). As this occurs, the relative wind affecting each wing changes drastically. As in the situation depicted in Fig 4 for a right rudder input, it is apparent that the relative wind now flows directly across the left wing while it flows almost parallel to the leading edge of the right wing. This change unstalls a moderate portion of the aft middle of the left wing, thereby increasing significantly the lift generated by that wing. Unfortunately, the change in relative wind results in most of the airflow reaching the right wing having passed over the fuselage. As it does so it blanks out most of the root section stalling it completely. In addition, it blows the turbulent air from the stalled root over the rest of the wing. In other words, this change in the relative wind had decreased the overall angle of attack on the left wing and increased the angle of attack on the right.

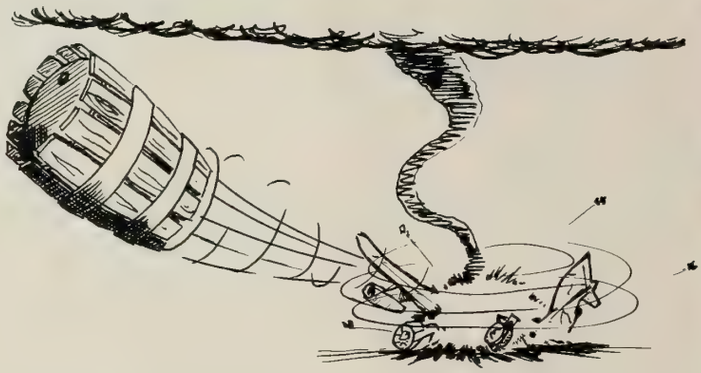
Considering that, prior to the rudder input, both wings were at or near the stall angle of attack, and that the airspeed of the aircraft was steadily decreasing, results in these changes being extremely rapid and irreversible. The left wing is now generating considerably more lift than before the rudder input. The right wing is almost completely stalled. The difference in lift generates an extremely rapid snap roll and a resulting spin. Scope films taken during this snap roll show a rate of roll that is amazing. This rapid change resulting from the rudder input is the result of the aerodynamic coupling of the yaw angle coupled to the angles of attack of the wings.

I hope that this explanation from an airflow standpoint has been more meaningful than a discussion on how the yaw angle induced by the rudder input couples with the angles of attack of both wings. ★

ABOUT THE AUTHOR

A native of Indiana, Lt Brown entered the Air Force through ROTC with a BS degree in aeronautical—astronautical engineering from Purdue University. Since pilot training he has been stationed at K.I. Sawyer AFB with the 87th Fighter Interceptor Squadron.

HURRICANE in a barrel





LT COL ROBERT J. BRUN, Directorate of Aerospace Safety

Some jet engine builders might take exception to calling their product a barrel but none can deny that the forces generated inside these powerplants are comparable to a hurricane. Air Force personnel injury statistics lend ample support to this comparison and the need for increased respect in terms of minimum safe distances from operating engines. This is especially true of the engines on jumbo-sized aircraft.

Facility planning guides for jumbo operators list the area within a 25-foot arc of the intake as a danger zone which should be clear of personnel and loose equipment when the engine is operating above idle thrust. At break-away power (11,000 lb thrust) the exhaust core speed is 80 MPH for a distance of 100 feet, decreasing to 65 MPH at 200 feet. These velocities are doubled at takeoff thrust and the effective distance increases as well. All aircrew and ground support personnel should be aware of this and the fact that the larger diameter of these engines results in a broad band of dangerous turbulence as opposed to the narrow higher velocity wake of the smaller jets. We learned an expensive lesson on the strength and range of the jumbo's wake during ground operations just this past summer.

A heavy jet was being taxied from the fuel pit to the ramp with all four engines operating. A twin engine fighter was parked on a hardstand 800 feet away with its tail pointed toward the jumbo's. Both engines on the fighter were motorized and ingested enough sand to require replacement. This episode should dispell all doubt as to the muscle and staying power in the tremendous volume of air processed by the large turbofan engine. However, one of the worst engine wake accidents we've experienced involved a single engine fighter.

An F-100 was on a maintenance runup pad with the engine operating at approximately 70 percent rpm. The crew chief of a nearby aircraft, who was wearing a newly-acquired set of ear defenders, was running across the ramp to his plane. He failed to see or hear the frantic warnings from several personnel nearby and cut diagonally across the engine wake about 30 feet behind the tailpipe. He suffered fatal injuries when he was lifted up and cartwheeled 78 feet across the pavement.

The intake side has also accounted for its share of damage to humankind. In most cases the victim met fate more than halfway, through inattention or carelessness. A minimum safe distance of 25 feet from the inlet of an operating engine is pretty standard, even on the smaller jets. It is mindboggling to read about people who "backed into the inlet," "peered around the lip," and "inadvertently moved forward from alongside" while working on operating engines. These actions re-



Left, top down, airman removing chocks must be aware of APU exhaust; checking flight controls with engines running; checking fasteners with engine running. Above, engine check with engine at high power setting; ground observer with microphone and earphones during engine check.

sulted in severe injuries such as the following:

- The airman was drawn backward into the engine. His right arm was amputated below the elbow.
- As the engine was pulled back to idle, the airman moved forward to get away from the surge bleed valve. He was drawn into the inlet and lost all the fingers on his right hand.
- The airman was adjusting linkage at the fuel control. He stepped in front of the engine, was drawn into the intake, and lost his left forearm.

The three mishaps above all occurred on C-135 aircraft. In the first case the ground crew were dressed in rainwear with hoods. This and the second mishap both took place at night. Although there is a definite message intended in stating these adverse conditions, it is equally significant to note that the last mishap happened in fair weather at high noon.

Support personnel on B-58 and B-66 aircraft had several vis-a-vis encounters with the first stage compressor section but it appears they were luckier in the degree of injury that resulted. One ground crewman was pulled in up to his hips before the rest of the crew reacted and yanked him out again. He came away with relatively minor internal injuries. The luckiest of the bomber group was a B-66 navigator. He had deplaned to make a pre-shutdown check and accidentally walked into jet blast. He sustained a broken collarbone and second degree burns which were limited by his nomex, the lower edge of his helmet, and a fully closed visor. He narrowly missed having his face seriously burned.

Small fighters and trainers probably have more of these mishaps than our records indicate since a nondamaging/no injury occurrence involving a close call with a small intake isn't necessarily reportable. The increased seriousness of personnel/intake encounters in the big double barreled F/TF's more than makes up for this.

Both the F-101 and F-4 have lifted people from the ground ahead of the intakes. One such mishap in the former type caused a broken collarbone, then a skull fracture when the compressor stalled and ejected the man back onto the ramp. An F-4 fuel specialist was ingested during engines running troubleshooting of a centerline tank problem. The pilot had his head in the cockpit when the airman came out from under the fuselage and stood up. The engines were running at 85 percent and the man was pulled into nr 1 intake. His belt caught on the bellows air probe preventing further ingestion, but it also produced a deep wound in his lower back.

Some of the examples listed above reach back pretty far and some do not involve aircrew members, but there is an aircrew lesson in every one. The size and power of our jet engines are ever increasing and, for those who people our flightline activities, the importance of learning these lessons—the easy way—grows in direct and infinite proportion. ★

OPS TOPICS

FIRE EXTINGUISHER LEAK

A crew chief was performing a postflight when he accidentally struck the installed A-20 fire extinguisher with his foot. This caused a discharge of chlorobromomethane into the cockpit. The lower level hinge pin had fallen out of the extinguisher negating all safing and locking features and thereby allowing discharge from a slight pressure. The hinge pin in question did not have riveted heads or self locking nuts. Instead it was a "press fit" straight brass pin. After the pin had worn slightly, normal aircraft vibration caused the pin to drop out. It's a good thing the mishap did not occur at 35,000 feet.

A LITTLE LOW

A sister service UH-1 was returning to base after a mission when it struck an electrical wire. The wire damaged the Huey control tube slightly and caused a fire on the ground which burned approximately one-half acre.

IN-FLIGHT FIRE ALMOST

An RF-4 crew returning from a cross-country had stored the downlocks, extra drag chute and their personal baggage in the aft camera compartment. A plastic hang up bag was touching the hot air duct going to the rain removal system. This should not have been a problem since the rain removal switch was off and the pipe should have remained cool. However, the rain removal bypass valve failed, allowing hot bleed air to enter the pipe. The heat from the pipe melted the plastic bag and burned a civilian sport coat and shirt beyond repair. Fortunately a fire did not break out. There have been quite a few close calls and some major accidents because of items like this stored in aircraft. Next time you pack your equipment take an extra minute to be sure that you won't get an unpleasant surprise.

SAFETY FEATURE OVERRIDE

A civilian instructor and his student were practicing approaches and landings in a light plane with retractable gear. When the instructor decided to demonstrate a 180 degree accuracy landing, he put the gear handle in the override position so it would not come down automatically on downwind but could be put down on final. The instructor explained what he was doing throughout the maneuver until touchdown. Then after the aircraft slid to a stop on the belly, the instructor tried to explain why he forgot to lower the gear.

TRAFFIC CONGESTION

A C-141 had an emergency shortly after takeoff. After burning down fuel it landed without incident. During rollout the pilots observed a light civilian aircraft sitting on the edge of the runway about 2000 feet from the departure end. The two aircraft had landed simultaneously on opposite directions on the same runway. The student pilot in the light plane apparently became confused and landed at the air base instead of the nearby municipal airport. An accident was probably averted when the lightplane pilot reported on the ground and the civil base controller realized he must be on the military base and directed him to clear the runway and report on the military tower frequency.

Editor's note: Aero club instructors: Are your students familiar with the airports they fly to? Or, could they be involved in such an event?

OPS TOPICS

AIR TRAFFIC HAZARD REPORTING

The Air Force is developing a new method for reporting hazards involving air traffic to give better tracking and response in this area. Air traffic hazards, including near midair collision reports will be removed from AFR 127-6 and incorporated in a new, as yet unnamed, regulation. There will also be a special form for these reports. The new regulation is scheduled for publication in July and there is already a test of the form in progress. So be on the lookout for the new system. Also ALSAFECOM 09/75 announced USAF endorsement of the FAA Aviation Safety Reporting Program. A message address was provided so that our hazard reports involving air traffic would be entered in the FAA System. Effective 15 April 1976, NASA assumed responsibility for the Aviation Safety Reporting System (ASRS). Our air traffic hazard reports are now being addressed to NASA. We continue to encourage USAF participation in the ASRS by completing a NASA report for those events not reported through the USAF Hazard Report Program. The NASA Report Forms (NASA ARC Form 277) are available through the local General Aviation District Office (GADO) and at any FAA air traffic services office. Details of the ASRS are given in FAA Advisory Circular 00-46A which was distributed in April 1976.

T-39s VS BARRIERS

Shortly after the T-39 crossed a BAK-12 cable on takeoff, the right main gear collapsed resulting in a major accident. While the final investigation is not complete, the major command has issued a message reminding pilots of the caution notes in TO 1T-39A-1 about crossing barriers at high speed.

NEW RADAR

The Air Force has received the first production model of a new approach control radar. This new system, the AN/TPN-19, is a sophisticated and highly mobile all weather ground approach control facility. It is effective and reliable even in heavy rainfall. The big advantage to the TPN-19 is its mobility. It can be set up quickly in a variety of tactical situations and is adaptable to use in natural disasters where permanent facilities have been damaged. The three "packages" which make up the unit are transportable by tac airlift, helicopter or surface means. They include an operations facility, a 60-mile radius surveillance radar and a precision radar effective out to 20 miles. Eventually the Air Force will have 11 of the TPN-19's.

FROM BAD TO WORSE

The pilot was on his first night transition mission in the A-7D and everything was okay until the landing roll. At about 40 knots the pilot turned off the antiskid, then he realized he was going too fast to make the turnoff he wanted. He applied brakes with sufficient force to lock both main wheels and blow the tires. He didn't know the tires had blown and did a 180 back to the turnoff. Since it was night the pilot did not see the rubber pieces (from his tires) on the runway and taxied over them back off the runway to the dearm area. Once there, the dearm crew told him about the blown tires, so he shut down the aircraft. A later maintenance investigation uncovered damage to the engine from ingested rubber. ★

CONFLICT ALERT

By the time you read this, all FAA ARTC Centers will have commissioned a Conflict Alert System. Computers at these Centers are now programmed to scan all traffic every six seconds. When aircraft are projected to get closer than minimum separation standards, their identification tags on the controllers' radar scope will flash or blink to alert the controller. In addition, a clear text message will appear on the scope advising the controller of the identification of these aircraft that are in conflict.

Conflict predictions are made by the program upon analyzing altitude (Mode C/reported/assigned) and track data (present heading of the aircraft without regard to the Flight Plan Route) and predicting where an aircraft will be two minutes in the future.

Visualize a cylinder of airspace and an aircraft within the center of this piece of airspace. (Figure 1.).

The dimensions of this cylinder are five miles across and 1,000 feet below and above the aircraft at altitudes above 29,000 feet. At 28,000 feet and below, vertical dimensions become 500 feet above and below.

Any time these two cylinders of airspace are projected (computed) to touch within two minutes (Figure 2) an alert will flash on the radar scope. Furthermore, an immediate alert will flash any time the cylinders of airspace are penetrated vertically by approximately 300 feet.

The system is now in use at 18,000 feet and above. Some centers are in a test status to cover the airspace down to 12,500. It is expected that all centers will soon be able to activate the system at 12,500 and above. (All aircraft operating above 12,500 feet MSL in controlled airspace are required to have a functioning altitude reporting beacon. —ed.) ★

From Air Canada Grapevine

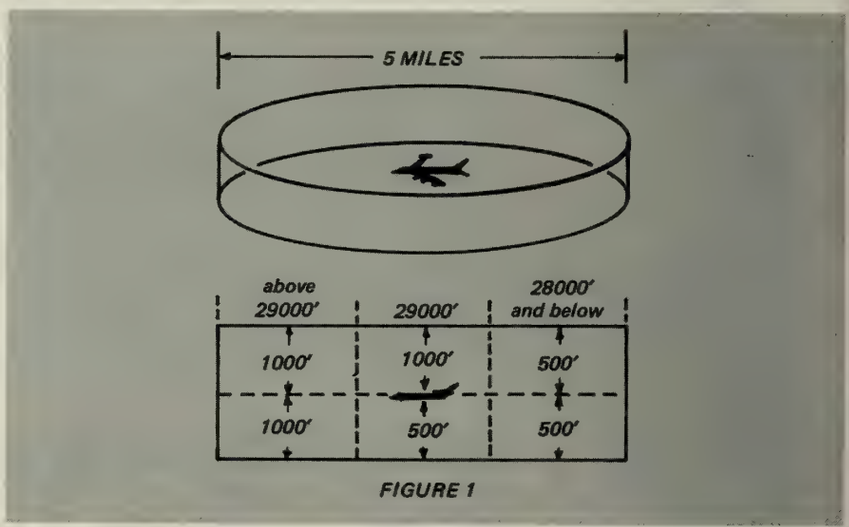


FIGURE 1

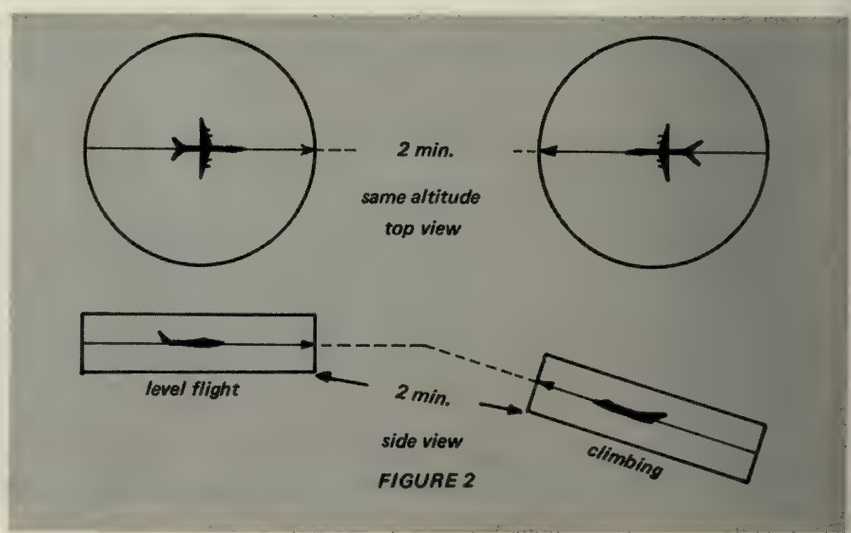


FIGURE 2

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TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



Capt ROGER E. LAMAN

3d Tactical Fighter Squadron
388th Tactical Fighter Wing

On 24 June 1975 Captain Roger E. Laman was flying as nr 2 in a six ship A-7D deployment mission from Anderson AFB, Guam to NAS Barbers Point, Hawaii. Captain Laman was level at FL270 and had just completed his third refueling disconnect when his engine started to compressor stall. Captain Laman retarded the throttle to idle, lowered the nose to increase airspeed, and when this didn't clear the stalls, switched to manual fuel. This action had no effect and the compressor stalls continued. The turbine outlet temperature started to rise and it became apparent the engine would have to be shut down in an attempt to break the stalls. At this point the flight was approximately 1190 miles west of Hawaii and 460 miles southeast of Midway Island, over the Pacific. Captain Laman continued in the glide, deployed the RAT and stopcocked the throttle. The compressor stalls cleared and an immediate airstart was accomplished. By this time, Captain Laman had descended through 10,000 feet and as the engine accelerated, fluctuations in fuel flow and rpm became apparent. The decision was made to let the engine run in manual fuel and the flight was turned toward Midway Island. A slow climb back to FL200 was initiated utilizing minimum throttle movement. When Midway approach control could be reached a straight-in precautionary landing pattern to Runway 06 was requested. Captain Laman completed an uneventful straight-in landing at Henderson Field approximately one hour after engine restart. Post flight investigation revealed internal engine damage and fuel control components out of adjustment which caused the engine compressor stalls and prevented subsequent clearance without engine shutdown. The decisive action, calm attitude and exceptional skill of Captain Laman averted the possible loss of a valuable combat aircraft. WELL DONE! ★


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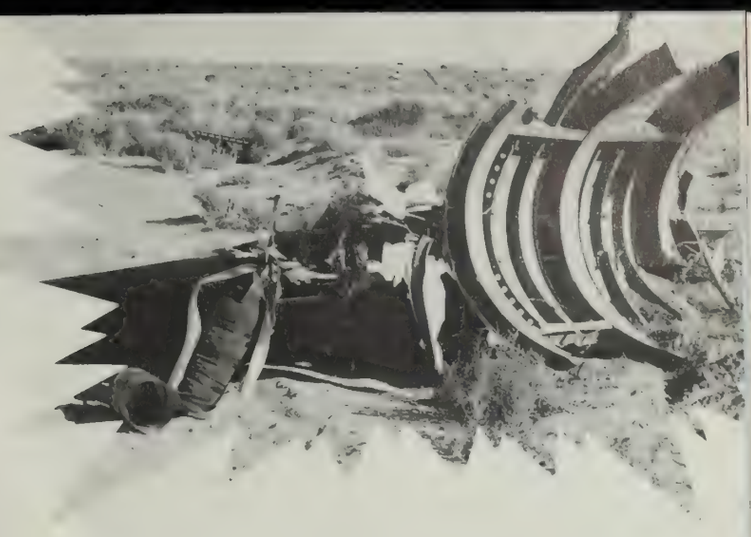
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JUNE 1976 AFRP 127-2 VOLUME 32 NUMBER 6

PEOPLE CAUSE ACCIDENTS



LT COL JOSEPH P. CLINE
Directorate of Aerospace Safety

It is people who cause aircraft accidents. The people who design the planes, the people who make the parts, people who put them together, people who maintain them, and the people who fly them. You can take that through as many iterations as you like. The people who provide the specifications, and those who supervise the production, assembly, maintenance, and flying. In fact, you can trace the causes through activities related to flying all the way to commanders, policy makers and authors of various regulations, manuals and technical data.

But the *real* causes are as elusive as the proverbial "they," the regular crew chief or the guy who has the big picture. It depends on your point of view—on how you perceive the accident. That is where the finger pointing game comes in. After investigating some accidents, the only conclusion is that it didn't happen because everyone was clean. The pilot was our best old boy. The entire maintenance complex was the cream of the crop. The aircraft had just come out of overhaul (not on Monday or Friday) with all the latest mods. And the entire chain of command consisted of fair haired boys with the highest intentions. But we have one less aircraft and someone caused the loss.

Keeping accident causes in mind, let's shift our thinking a bit and look at the mission. We say "the mission-safely." To some that may seem like a paradox. We, the Air Force, have a charter to be able to fly and fight. We must be ready to perform many rather difficult missions effectively and efficiently. By necessity, we are always pushing technology and flying to the edge of the flight envelope. Anything else would be wasting resources and accepting second best.

Accidental losses reduce our efficiency and capability. This throws us into a perplexing situation. We must pick a course of action or rather a philosophy of operation somewhere between two extremes. At one end of the spectrum is the "damn the torpedoes, full speed ahead" attitude where we say that flying is inherently dangerous, so press on and accept the losses. At the other end we could avoid all accidents by not flying. In actuality, we have vacillated back and forth. Should we adopt the sink or swim approach to training pilots where we accept the losses early, when they are cheaper? Or do we hand feed a guy through his flying career, hoping that he will pick up enough along the way to do it on his own if he ever needs to?

Why don't we optimize our operational capability through a program of maximizing training effectiveness and minimizing accident potential? It is a "mission-safety" equation that includes a thorough understanding of the requirements and hazards.

As you read through this issue, you will find that many of the articles address people problems. Col Jones in "What Are You Doing for Green 16" and Capt Laird in "Don't Let Your Wingman Down" both discuss the need for pilots and operational supervisors to understand and acknowledge physical problems, and Maj Spey in "No Joy" addresses the cockpit environment. Capt Sweeny illustrates in "Time Bomb" the problem of coping with stress and anxiety. These and other people problems continue to cause accidents. The need to learn from past accidents is emphasized by both Maj Allocca in "Feedback and USAF Accident Board Recommendations" and Capt Bloom in "No New Causes."

So—read on and find your place in the safety equation. We can do better, you know! ★



What are you doing for GREEN 16?

Material things are important in accident prevention; but the human factor demands as much attention.

LT COL MURPHY NEAL JONES
Commander, 357 TFS
Davis-Monthan AFB AZ

Lt Col Jones, eyes glued to the television, sat in his favorite easy chair but his mind was far away recounting the events of the last few weeks. It was more than a month now since he, as squadron commander, had gone to the homes of two of his pilots to break tragic news to their wives.

Just this morning, the accident board finished their final report: Cause — Material Failure. Many dedicated people worked long hours to dig out the clues to the full story. The sequence of events appeared cut and dried, although it wasn't an easy case.

During basic maneuver practice, one aircraft had suffered a loss of one hydraulic system — an emergency, but certainly a common one. While rejoining to return home, the two planes collided almost canopy to canopy, destroying both aircraft. Neither pilot had a chance to eject. Further investigation into the twisted wreckage had added new dimensions to the accident.

Col Jones thought briefly of each new fact as it had been uncovered: The second hydraulic system with a clogged line to one aileron . . . an actuator which leaked out those few precious drops of fluid which would have damped the flutter and prevented the metal fatigue. He could picture the two aircraft closing for rejoin when suddenly one, out of control, rolled up and over into the other.

The picture was so vivid, the sound of tearing metal threw his thoughts to the accident board findings. He and other supervisors had not been listed as a cause factor. The pilots were current in the events to be flown and there had been no crew rest or other violations of regulations. Yes, a group of his peers had found him free of any fault and they had dug deeply into the facts.

Col Jones knew that in another court he had not been vindicated. In the dark recesses of his own mind, he served as both defense and prosecution, pondering not only the facts but the intangibles. On his scales of justice, the intangible could bear a heavy weight.

Jones knew the pilots of his squadron were second to none. They had always accomplished every mission whether it was daily flying, additional duties, meetings, or the mountains of paperwork which never stop flowing. He thought of his own schedule and how rough it could get at times.

There had been no real clues to indicate any imminent problems. Oh, there were always last minute schedule changes to replace a pilot who had a meeting or had to meet a last minute suspense, but there was always another pilot eager to fill the gap. Yes, he could remember a few flight briefings which seemed not quite as smooth as normal and maybe a few small details had not been covered; but, with his experienced group of pilots, it had never affected a mission.

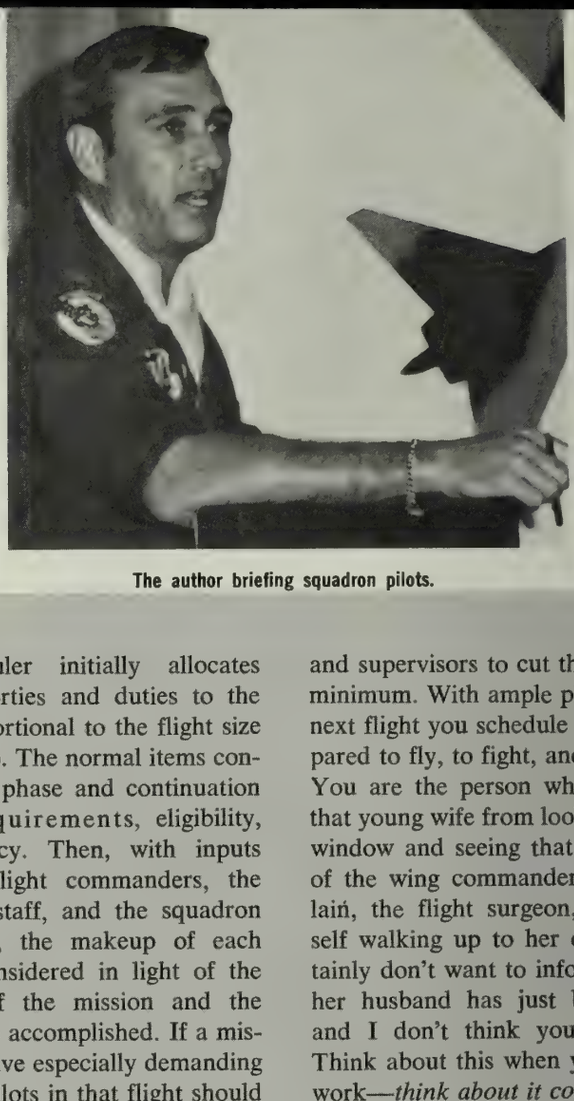
As his mind pulled and tugged, Col Jones wondered if he had spent enough time really understanding the men of his own unit. On that tragic day, could he have spotted some small clue which shouted, "Reaction time is slow! The risk factor is climbing!"? Could it have made a difference? He did know that there was a risk in flying, but had he done everything possible to cut the risk to a minimum? As he fell asleep, the television screen now only a test pattern, he mumbled, "I don't know, I really don't know!"

Fortunately, this story of the midair collision and the death of the two pilots is imaginary, but it could very well be true. How many accidents and how many deaths have been caused by those kinds of circumstances when an alert pilot with fast reactions could have saved the day?

I do believe that the commanders and supervisors of flying units know the regulations and try to follow them to the letter; however, in this day of complex aircraft, this is not sufficient. We have the responsibility of keeping our pilots alive, and with the economic crunch on the military, we must preserve the combat assets of our country. Following regulations to the letter is only the beginning.

When you schedule that young lieutenant or that attached colonel do you only ask yourself, "Is he legal to fly this mission?" or do you propose this question, "Have we provided him enough training to adequately complete the mission, and is he physically and mentally prepared to do so?"

continued



The author briefing squadron pilots.

We all know that we cannot stop every accident, but we can prevent senseless accidents, and we may be able to avert some which would normally be considered unavoidable. We can do this by being aware of the daily capabilities of our people. You, as a squadron commander or supervisor, must be able to communicate with your people. You must know them both professionally and socially.

My experience in TAC has shown me that pilots have several traits (be they real or imaginary) that can be either beneficial or detrimental depending on the situation. A pilot is both aggressive and cocky, and he believes that he is better than his peers. Aggressiveness is good; being cocky by itself, does no harm; and believing that he is the best, promotes confidence and the will to do better. However, when these qualities are mixed, you have a pilot who generally won't say no.

A pilot doesn't like to admit a flaw in his ability. He rarely will ask his supervisor to replace him on a demanding mission, even though he knows he is not up to par. He may have had trouble at home, one to many at the bar, or he may only be having a down day. This is where knowing and communicating with your people is important.

You must persuade the members of your unit to be honest with you and most importantly, with themselves. Your flight commanders can also provide valuable insight. They must be more than mere figureheads. They must act as operations officers and psychologists simultaneously. Since they maintain close touch with individuals in their flights, they can be your link between operational and personal requirements.

In my squadron (the 357th Tactical Fighter Squadron), we attempt to consider all of these factors when designing our schedule. The squadron scheduler initially allocates available sorties and duties to the flights proportional to the flight size and makeup. The normal items considered are phase and continuation training requirements, eligibility, and currency. Then, with inputs from the flight commanders, the operations staff, and the squadron commander, the makeup of each flight is considered in light of the objective of the mission and the events to be accomplished. If a mission is to have especially demanding tasks, the pilots in that flight should have had recent flights preparing them for that mission. Highly capable pilots are placed in those flights which have pilots who are not so strong. These and other similar requirements usually ensure that the original schedule has covered all known conditions.

Further refinements must be made on a daily basis. For example, the mission which was preparatory to the demanding mission may have been weather cancelled or aborted. Individual problems or requirements might now dictate a personnel change within a flight. That new flight lineup might now require a change in the mission objective. The list of possibilities is endless.

There are no easy methods to eliminate accidents; but, it is up to you, the squadron commanders, and supervisors to cut the risks to a minimum. With ample planning, the next flight you schedule will be prepared to fly, to fight, and, *to return*. You are the person who can keep that young wife from looking out the window and seeing that grim scene of the wing commander, the chaplain, the flight surgeon, and yourself walking up to her door. I certainly don't want to inform her that her husband has just been killed and I don't think you do either. Think about this when you drive to work—*think about it constantly!* ★

Lt Col Murphy Neal Jones is the Commander of the 357th Tactical Fighter Squadron (TAC), Davis-Monthan AFB, Arizona. He attended Tulane University, New Orleans, LA, where he was the first string center and linebacker for three years, a member of the AFROTC and commander of the Arnold Air Society. He graduated on May 30, 1960 and was commissioned a Second Lieutenant in the Air Force. After pilot training, he served in several assignments including two combat TDY tours to Southeast Asia. He again volunteered to return to SEA in 1966. While assigned TDY to the 333rd TFS at Takhli Air Base, Thailand, he was shot down and captured over Hanoi on June 29, 1966. Col Jones was repatriated on February 12, 1973. After his return from Hanoi he attended the Armed Forces Staff College, graduating in January 1974. He was then assigned to Randolph AFB, Texas for a flying refresher course, and was assigned to the 355 TFW at Davis-Monthan AFB, Arizona in April 1974.

WIRE ACT

Ask a helicopter pilot what his greatest occupational hazard is and he'll probably answer "wires." Every year some chopper pilots come out second best in an argument with a wire —sometimes permanently.

It has been policy to dismiss such "mishaps" with the assertion that "if the pilot hadn't been flying so low" . . . or "if the pilot had been clearing properly. . . ." Such simplistic answers don't fit the facts. First, not all wires are close to the ground. One collision occurred *over 1700 feet above the ground*. The wire was stretched across a valley and there were no poles visible. When the investigators measured the height they found the wire was 1782 feet AGL.

Wires are often invisible to the aircrew, even if they are clearing properly. A pilot was killed when his helicopter flew into power lines stretched across a Pacific Coast inlet. The wires were obscured by the superstructure of a bridge in the background.

The problem can be solved by making wires more visible. Unfortunately, efforts to do this have not been very successful. The technology is available, e.g., colored plastic balls hung on the wires; lights—even one run by static electricity, something always present around high voltage power lines; however, little has been done.

There is some evidence that this attitude may be changed. In the past the appellate courts generally ruled that when an aircraft struck a power line or transmission line, the liability rested solely with the pilot. But some recent decisions have resulted in judgments against power companies. There are also aviation and citizens groups attempting to sponsor legislation requiring marking of hazardous wires.

Helicopter pilots should take it for granted that at low level there will be wires. But 1782 AGL does stretch the imagination. Aeronautical charts will help; so will NOTAMS, although neither is a 100 percent guarantee.

It would be nice if all wires and cables that could snatch a chopper were adequately marked, but that's not the way it is. Until the wires are all marked, you can't beat good flight planing with due regard for the weather and some very busy, very sharp eyeballs. These may prevent one wire act that doesn't even belong in a circus. ★



Not all wires are close to the ground.....

OPS TOPICS

NEW MATERIAL FOR CHUTES

AFSC's Flight Dynamics Lab has completed testing of a new fiber as a possible successor to nylon for drogue parachutes. The new material called Kevlar® was developed principally for tires but can be woven into parachute material that is twice as strong as nylon. Thus, parachutes of the future may be only half the weight and volume of their nylon counterparts. The ribbon type parachutes were tested in the wind tunnel at AFSC's Arnold Engineering Development Center. Dynamic loads were measured on deployment at speeds of approximately 600 mph and simulated altitudes from 5000 feet to 35,000 feet. The tests also measured steady-state loads from 400 to 900 miles per hour.

IT'S THAT TIME AGAIN

The Herky Bird was IMC at FL 200. Although the preflight briefing had not forecast any thunderstorms, an update from another aircraft indicated activity on track. Since the airborne radar was inop, the crew elected to reverse course and descend to VMC. During the descent the aircraft was struck by lightning which damaged the radome.

LITHIUM BATTERIES REPLACED

The item manager at Hill ALC has directed that all lithium batteries NSN 613-00-204-5702LS be removed from service and replaced with mercury batteries. All major commands have received a message on this subject. Use extreme care with batteries showing signs of deterioration since there are serious hazards from sulfur dioxide to personnel handling defective batteries.

TOO MUCH PULL

An A-7 pilot was performing a preflight of his life support equipment. He was a bit too enthusiastic when he performed the security check of the arming cable swag ball. He exceeded the 10 pound pull tolerance and fired the parachute automatic release cartridge.

GLOBAL HF STATION— NEW PROCEDURE

Instructions for the use of Global HF Aeronautical Station were changed effective with the 24 April 1976 issue of FLIP IFR Supplement. The new procedures require USAF aircrews to maintain radio contact with the Area Control Center responsible for the FIR except when a USAF HF station maintains "Primary Guard" for that FIR. Changes were necessary for DOD aircrews to comply with ICAO procedures. Refer to FLIP for details.

CORRECTION

On Page 8, *Aerospace Safety* magazine for April, a drawing of an aircraft closely resembling a DC-10 was used to illustrate an article. The article did not mention the type of aircraft involved but it was not a DC-10, and we regret that there could be any implication that a DC-10 was involved.

OPS TOPICS

DO YOU LIKE CHALLENGES?

The Safety Education Division at AFISC is looking for a rated major or major selectee to be a safety education staff officer. He will develop and manage new safety education programs and manage existing ones, both audiovisual and instructor oriented. He will also work directly with the chief of the division on other areas of safety education. If you would like a challenging and different job, contact Lt Col Raley, AFISC/SED, Norton AFB, CA 92409, AUTOVON 876-2407.

FLIP REALIGNMENT IN THE PACIFIC

On 15 July 1976, the Pacific and South Asia (PSA) and the Australia, New Zealand and Antarctica (ANZA) FLIP Enroute and Terminal publications will be combined into a single package. The title of the new publication will be the same as Area Planning 3—Pacific, Australasia and Antarctica (PAA). The new PAA FLIPs will also be published on an expanded cycle.

The PSA and ANZA Supplements will be combined into a single PAA Supplement. The Enroute Chart coverage will remain the same, but the current ANZA Charts 1-9 will become PAA Charts 11-19. The charts and supplement will be published every 16 weeks with a Military Aviation Notice (MAN) issued at the intervening 8-week mid-point.

The Instrument Approach Procedures (IAPs) will be combined into three high/low combination volumes. These volumes will also contain the Standard Instrument Departures (SIDs) plus any existing expanded airfield diagrams and Standard Terminal Arrival Routes (STARs). The radar minima for the airfields will be moved from the Supplement to the front of these volumes. The IAP volumes will be published every 24 weeks. Two bound MANs will be published at each of the 8-week intervals between cycles with the second MAN being cumulative.

CLIPBOARDS (FOD)

During cockpit check on a recent T-38 sortie, the crew found a small knob on the left cockpit console and identified it as the light control knob on the MXU-163/P pilot's clipboard. One way to keep this type of foreign object (FO) out of the cockpit is to lock the set screws which hold the knobs to the shaft. This can be accomplished by the application of adhesive sealant, silicone, RTV (MIL-A-46106, Type I, NSN 8040-00-103-9378) or similar material to the threads of the set screws by your protective equipment technician. Crewmembers should check their life support equipment as a possible FOD source, as well as for function, prior to each flight. ★

NO NEW CAUSES



CAPTAIN JAMES P. BLOOM
Alaskan Air Command

One of the instructors at the Flight Safety Officer Course presented our class with the idea that there were no new causes of aircraft accidents. Naturally enough, the point was debated with some people supporting the thesis, and others opposed. This concept could not be resolved to everyone's total satisfaction; however, some aircraft accidents illustrate the idea that there are no new causes of aircraft accidents

Flying safety meetings are usually where aircrews get the opportunity to listen to mishaps that have occurred to others. The theory is to learn from mistakes others have made in order to keep from duplicating those errors. Another reason, albeit, very similar, is to find out how someone was able to save a rapidly deteriorating situation just in case the same thing happens to

your wingman. (It always happens to the other guy. Right?) Thus, you would be able to give him the guidance he needs to get back to the "home drome."

After hearing about all these accidents and incidents that have happened to others, have we really learned anything? After listening to the causes of all these mishaps, have we absorbed this knowledge in order to avoid the same pitfalls that others have stumbled into?

Do we really learn from the mistakes of others and avoid similar accidents? Look at what happened to a T-33 crew, consisting of an instructor pilot and a pilot, who had an accident while they were practicing a simulated flameout approach (SFO). The accident sequence started after the aircraft was established on final. When the aircraft commander lowered the flaps to the full-down position, the T-33 developed an excessive rate of descent. The instructor pilot finally had the pilot reselect 50 percent flaps and add thrust, but it was too late. In a vain attempt to stretch the glide, the aircraft commander raised the flaps completely. The T-Bird was destroyed when it came to rest short of the overrun. The crewmen were not seriously injured.

Most T-Bird jocks probably were briefed at their flying safety meetings on all the causes and findings related to this accident. Some aircrews may have filed the details away in their heads to prevent such a mishap from occurring to them, but obviously not all T-33 pilots learned from this accident. Approximately three months later, another crew consisting of a pilot and an instructor pilot in a T-Bird were shooting an SFO and got low on the glide path. The instructor pilot twice commanded the aircraft commander to increase the thrust, but the throttle was never advanced until the instructor pilot did it himself. Finally, in another futile attempt to reach the runway, the aircraft commander attempted to raise the flaps to the 50 percent position, but mistakenly selected the full-up position. Scratch one more T-33.

Again, the crewmen were not seriously injured. The causes in both accidents were the same: operations factor, direct-operator error; and supervisory factor-direct. The instructor pilots in both cases allowed the pilots to fly into dangerous situations from which they could not recover.

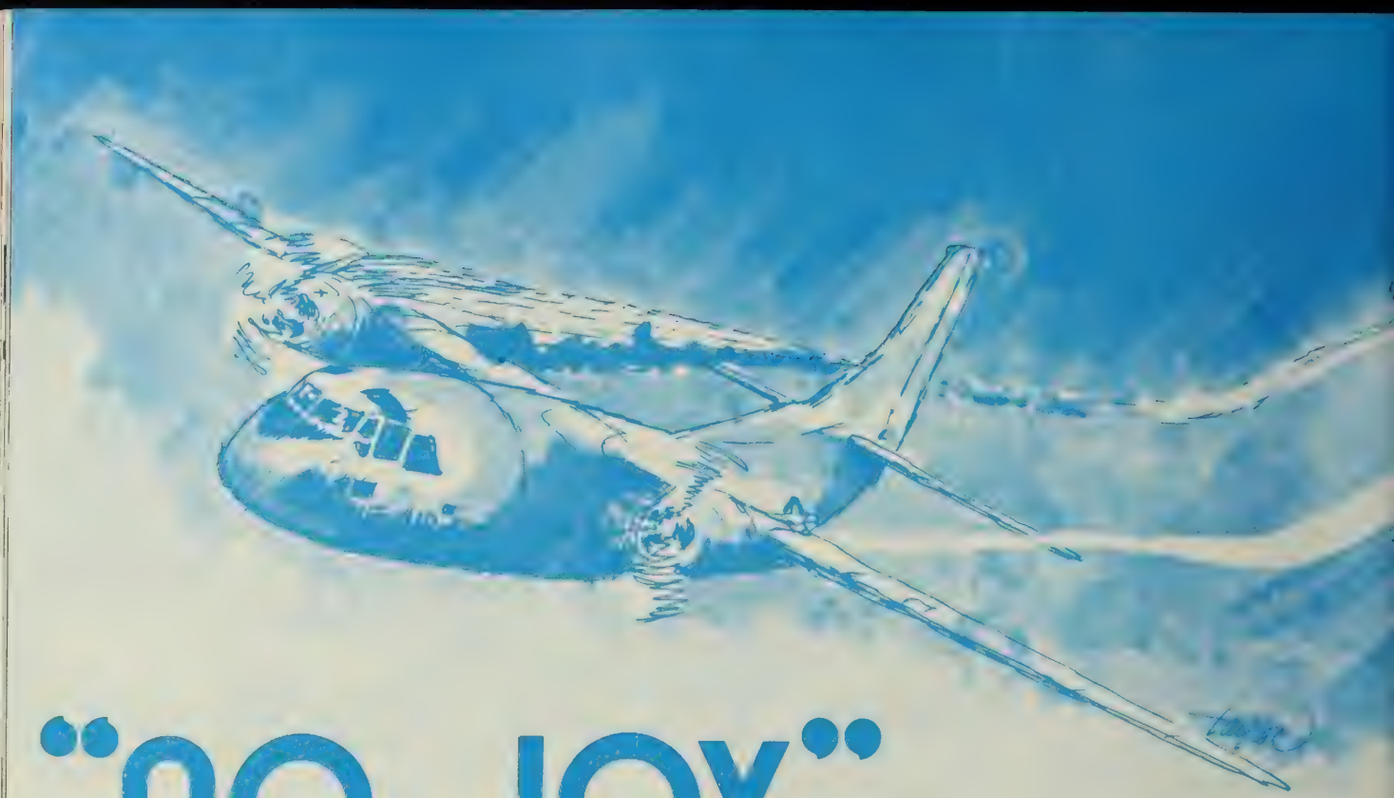
Another example of causes repeating themselves involved F-4s flying AI/ACM. The first accident occurred during tactical intercept from a 2 vs 1 scenario. During the maneuvering, the defender lost sight of one of the attackers, the attackers never saw the defender, and during the ensuing battle, one of the attackers and the defender collided. The point illustrated by this mishap was that the participants lost sight of each other and continued the engagement. They should have broken off the engagement and set upon another one. Fortunately, everyone lived through this accident.

Most fighter crews were probably briefed on this mishap, especially those in the ACM phase of training. The rules of engagement were probably emphatically stressed during briefings because of this accident. Again, some aircrews did not listen to the lessons illustrated by the previous midair, nor did they listen to the rules of engagement. They couldn't have, because less than one month later another pair of fighters lost sight of one another and collided during an ACM engagement. The only difference this time was that two of the attackers ran into each other instead of an attacker and a defender as in the previous accident.

The causes of both ACM accidents were basically the same: not adhering to the rules of engagement that had been established in order to prevent such accidents and ensure safe training.

These accidents were preventable. At least the second accident in each pair should never have occurred, because the first T-Bird accident investigation had already been completed with all the causes published. The aircrews should have been aware of the mistakes the first T-33 crew made and thus avoided the second T-Bird SFO accident. While the F-4 crews did not have the benefit of all the findings from the first midair, they should have been fully aware of the hazards involved in ACM as illustrated by the previous midair, before they flew their mission.

No new causes? Probably true. Once we know the causes of accidents, we should be able to prevent them. This is where accident prevention becomes the responsibility of the individual and not the safety officer. The safety officers make the causes of mishaps known to the aircrews, then it is up to the aircrews to use that information. That means it's all up to you—the aircrew. After all, what have you got to lose? ★



"NO JOY"

MAJOR JACK SPEY
475 ABW

It was 0500, runway 25 and cleared for T/O. On the hack, the first of nine C-123s rolled down the runway, at 15 second intervals. In the last of the "nine shipper," power checked good; and at 110 knots we were airborne. As the wheels hit the well there was a muffled explosion, a slight shudder, and a briliant glow filled the dark cargo compartment.

Outside, flames engulfed nr two engine as the right fire handle glowed red. The pilot called for the fire handle to be pulled and the copilot pulled the illuminated fire handle feathering the propeller. (This step also cuts off the fuel, hydraulic fluid and arms the fire extinguisher.) The next step of this three step shutdown procedure, which normally takes 3-5 seconds to perform, was delayed due to excited interphone transmissions from a crew member in the cargo compartment. After 10-15 seconds, at the pilot's direction, the mixture was placed in the Idle Cut Off Position (Step nr 2) and with the fire now burning ravishingly, he instinctively called for the extinguisher to be activated.

At this point, 20-25 seconds, after all possible indications of fire were evident, (visual, oral, instrument, and the obvious), the copilot began looking for the fire extinguisher switch. He knew the general, if not specific, location but he was unable to locate it! Why? *Cockpit lighting!* Inability to find the extinguisher switch was not due to *lack* of illumination. The lights in the cockpit were so bright that the glow masked the location of the switch. The Fire Panel containing the switch was ablaze with light, as was the rest of the cockpit. The etching in the instrument panel that normally outlines the switch by back lighting was masked out by the brilliance.

This incident, not completely described, contains other lessons. Extinguishing systems contain sufficient agents to put out a fire if the proper procedures are taken quickly. If the whole barn is on fire before we decide to fight it, we may have to come up with another plan!

2000 hours, 14,500 feet, C-130 between Da Nang enroute Saigon RVN, 14 NE Saigon; WX—clear and unrestricted.

"Herky 41, this Paris control, you have traffic one o' clock, two miles east bound.

"Paris, Herky 41, no joy.

"Roger.

"Herky 41, Paris, traffic now twelve o' clock one mile.

"Herky 41, Roger . . . no joy!"

While dead heading from Da Nang to Saigon, I became bored riding in the cargo compartment and decided to join the crew. Not being a C-130 pilot, I was anxious to watch the Lockheed being flown and admire all the gadgets. After I arrived on the flight deck and plugged into the intercom, the pilot and I engaged in the normal chatter that takes place between pilots of different aircraft. He expressed sym-

pathy when I described the equipment on the C-123 and he seemed elated when I showed admiration for his auto-pilot, radar, crew bunk, etc. As the flight progressed toward Saigon, I instinctively monitored the radio chatter.

Paris Control (Saigon GCI) was providing traffic information to the dwindling number of aircraft as the flying day over Vietnam was ending. On seven occasions, Paris Control advised Herky 41 that he had traffic in the forward quadrant at 2-5 miles. In each case, the response was, "No Joy." When traffic was called, I would rubberneck over the flight engineer's shoulder for a better look. Unable to see the traffic, I nervously moved forward to the right of the copilot and pressed my nose against the windshield. In this position, I could see the star-filled sky and was able to see a number of other aircraft.

As we approached Saigon for landing, I nervously returned to the cargo compartment; but as I moved to the rear of the flight deck, it became evident that the brightness of the cockpit lighting was preventing the crew from seeing outside the cockpit. The windscreen and side windows were flat black and little or no light from outside the aircraft was reaching the pilot's eyes. If near miss situations were occurring, we in the cockpit were totally oblivious to the situation, except for those seen by Paris Control.

In both these incidents, the cockpit lighting was excessively bright. Far more illumination was being used than was required to adequately read instruments, see switches, and perform cockpit duties. In the first incident the overbrightness masked the location of critical switches. In the second case, visibility outside the cockpit was nil—preventing sighting of other aircraft.



"SEE and AVOID!"

If this article is being read in such a cockpit, ablaze with light, stop and see how well you can see outside the aircraft. If the stars are faint or not visible at all, gradually lower the intensity of your interior lighting. Each panel rheostat will require different adjustments due to the nature and quality of the lighting design and the importance of individual panels; however, over a period of 30-45 minutes of gradually reducing the intensity of each panel, the excess light can be removed without degrading interior visibility.

This process takes time, as the eye must simultaneously generate the visual purple necessary to improve night vision, but after the eye has reached peak performance and the minimum intensity level is reached, we will find that bright spots in the cockpit are removed, the cockpit is equally as distinct as before and the sky, stars, horizon and other traffic become visible.

While taking off at dusk or flying into the night, the eye naturally begins to generate visual purple and adapts to the growing darkness. As the cockpit grows darker and less distinct, slowly adjust and gradually *maintain* the minimum intensity you require to see those instruments and necessary cockpit controls. (The key word is maintain.) Slowly and selectively adjust the rheostats to *maintain* the minimum intensity required. In this way the eyes, the approach of darkness, and careful adjustments, work in concert to achieve the minimum required interior lighting and without jeopardizing or destroying the capability to see beyond the windscreen.

The careful effective use of cockpit lighting can ensure our ability to perform cockpit duties while night flying and preserve our ability to maintain adequate visual crosscheck outside the aircraft thus permitting us to "see and avoid" and to appreciate our sky. ★



Your Way Out

SSGT ROBERT J. PAETZ
3612 Combat Crew Training Squadron
Fairchild AFB WA

You have just been tossed out of your cozy warm cockpit and find yourself tumbling into a survival situation. That's a brand new mission. Could you hack such a mission, not knowing what it entails? Unfortunately, a lot of aircrew members have forgotten that they have an assigned mission even after they leave their aircraft. Let's look at what Uncle Sam says that mission is, and why.

The moment you depart your aircraft, Sam states you're to "return to friendly control without giving aid or comfort to the enemy, to return early and in good physical and mental condition." On first impressions, "friendly control" seems to relate to a combat situation. However, even in peacetime your environment may be quite hostile. Imagine parachuting into the Arctic when it's −40° F. Would you consider this friendly? I doubt it. If you are forced to crash land in the desert where temperatures may soar past 120° F, would this be agreeable? Hardly. The list is endless. Almost any place you might bail out, you can be confronted with situations difficult to endure. You want to "return to friendly control."



The second segment of the mission, "without giving aid or comfort to the enemy," is of course related to a combat environment. This part of your mission may be most effectively fulfilled by following our moral guide, the Code of Conduct. Remember, however, that it should be followed at all times and in all places. It *does* apply to the peacetime situation.

The final phase of the mission "to return early and in good physical and mental condition," will probably be the most strenuous requirement to accomplish. The most important criterion for successful completion of that part of the mission will be your WILL TO SURVIVE. Although this "will" is inherent in all of us, some will find it difficult to activate. Surely you've read stories or know of incidents where people have eaten their belts for nourishment, boiled water in their boots to drink as broth, or have eaten human flesh—though

this certainly wasn't their cultural instinct.

One incident where the will to survive was the deciding factor between life and death involved a man stranded in the Arizona desert for eight days without food or water. He traveled more than 150 miles during searing daylight temperatures, losing 25% of his body weight due to the lack of water. (Usually a 10% loss is considered fatal.) His blood became so thick that the lacerations he acquired could not bleed until he'd been rescued and had received a large amount of water. When he had started on that journey, something must have clicked in the back of his mind telling him to live, regardless of any obstacle which might confront him. And live he did!—on guts or will alone.

Let's flip the coin and check the other side of "will." Our location is the Canadian wilderness. A pilot ran into engine trouble, and chose to deadstick his plane onto a frozen lake rather than punch out. He did a beautiful job and slid to a stop in the middle of the lake. He left the aircraft and examined it for damage. After surveying the area, he noticed a wooded shoreline only 200 yards away where he could find warmth, food and shelter; he decided to go there. Approximately half way there, he changed his mind and returned to the cockpit of his aircraft where he smoked a cigar, took out his pistol and blew his brains out. Less than 24 hours later, a rescue team found him. Why did he give up? Why was he unable to survive? Why did he kill himself? Why do other people eat their belts or drink broth from their boots or take a bite out of George? No one really knows, but it's all related to the WILL TO SURVIVE.

Like a lot of other things in this world, your will may be improved upon. Let's take a look at some ways. In an emergency outside the cockpit you may have a tendency to panic or fly off the handle. That can usually be handled by sitting down, calming down and analyzing the situation rationally.

After your thoughts are collected and you're thinking clearly, the next step is making decisions. In all walks of life, some people always avoid making decisions by letting others do their planning for them. But in a survival situation that won't work. You're on your own, and every decision may mean life or death. When you make critical decisions, like how and where to build a shelter, how to signal, and where to find water and food, you've got to be flexible and plan ahead. Flexibility is essential because circumstances may not always go according to that plan. For example, you may have started to construct a shelter and hear an aircraft in your vicinity. You would probably want to postpone the shelter and attempt to get out a signal. I don't mean to be as flexible as jelly, but maybe like jam.

If you get in a pinch and find yourself without an item you feel is critical, use a little "Yankee ingenuity"—improvise. Today you might walk outside and see a tree and wonder how tall it is or what good shade it could provide. But in a survival situation, you have to look at that same tree in a totally different light. It may supply you with shelter, food, signalling, warmth and medicine.

Tolerance is the next topic of concern. You will have to deal with many physical and psychological discomforts, such as creepy crawlers, flying insects, loneliness, and maybe even "Sasquatch." Just by being in the military you've had a chance to learn to tolerate uncomfortable situations. Fine. Apply that to your new environment. You'll probably find it's not so bad.

Facing and overcoming childhood fears is another threshold you may have to cross. Realistically speaking, everyone has acquired childhood fears. For instance, why do you usually turn on the bedroom light when it's dark even though you've been there hundreds of times before and already know where every stick of furniture and every knick-knack is located? Is it a habit, or a reflex? Or could it be that when you were very young someone jokingly scared you in the dark? Maybe as a small child someone told you not to leave the yard because wild animals in the nearby woods might get you. And now you may find yourself in a strange dark woods which is the playground of these wild and ferocious animals. Old fears can be detrimental to your survival unless you learn to overcome them.

Perhaps one of the most important psychological factors to remember is optimism. With today's modern technology, it's likely someone already knows you are missing and a rescue team is being organized to find you. Like the old saying goes, "Keep the Faith, Baby!"

As you can see, the survival mission Uncle Sam has assigned you is not an easy one. This is just a peek at some of the ways you can succeed in that mission if you're ever "fragged" for it. If you find yourself in this predicament, I hope you'll remember that your WILL TO SURVIVE is Your Way Out. ★



FROM WHENCE WE CAME

THE RAID ON PLOESTI

MSGT DAVE SYLVA
63 MAW
Norton AFB CA



The Ploesti Raid was a costly fiasco marred by misinformation, mistiming, mistakes and outright confusion. Only determination and personal initiative saw it through despite all the odds against it.

"The defenses here are nothing as strong as they are on the western front. The majority of the fighters will be flown by second-rate Rumanian pilots who are thoroughly bored with the war. The anti-aircraft defenses are estimated to be 80 heavy and 160 light AA guns largely disposed for a night attack from the south along the railroad. The heavy AA guns should not trouble you at low altitude. Equipment has been installed for making smoke but has not proven to be effective. Now the defenses at Ploesti may look formidable on paper but remember . . . they are manned by Rumanians."

That was what the crews were briefed before they flew against one of the worst targets in the history of air war.

Even if the briefing were correct —and it wasn't—the mission would be a nightmare. If all went as planned—and it didn't—the strike force would have to fly nearly a thousand miles into enemy controlled territory, without fighter escort, and a thousand more miles

home. To avoid detection, the ops order called for a low level run across the Mediterranean and on into the target area. "Low level" was spelled out as thirty feet. The plane, Consolidated's B-24 Liberator, was a four engine, flying gas tank that handled like a truck.

If all went as planned, it would be rough. Fate, however, put her hand in and busted the plan. The rough mission turned into a nightmare of confusion, terror and hideous losses.

That confident briefing was not the product of a hyperactive information officer. It was the honest opinion of S-2, an error in judgment by Intelligence based on past experience with the target.

After the disaster at Pearl Harbor in December 1941, President Roosevelt requested plans be drawn up for the early bombing of Japan. Doolittle's raid was one result. A second, less known, was a B-24 mission designated HALPRO that was to fly from Florida to Brazil, span the Atlantic, cross Africa, on to India, Burma and China. Then in May of 42, to bomb Tokyo from the base at Chekiang. Before the job could be pulled off, the Japanese took the base at Chekiang and the mission was scrubbed.

Stranded in the Sudan, in eastern Africa, HALPRO was turned around and brought up to Egypt for a long haul strike into the heart of German oil production.

The forty refineries at Ploesti gave Hitler one-third of all his petroleum products and the highest octane aviation fuel anywhere. It was a strategic target in the truest sense of the word—probably the most valuable target in all Europe.

At dawn of June 12, 1942, the first American bombing raid against Europe in World War II began. The thirteen Liberators came in, unopposed, dropped their bombs and streaked for home before the enemy's fighters and flak batteries could be organized. We suffered no combat losses to speak of and the bombing results were no worse for the Germans. In fact, they wrote the raid off as an "Intruder" mission. The actual results though, would not be felt for another year and when they were, they would be deadly.

Our first taste of blood at Ploesti had not been as bad as we had expected and it lulled our Intelligence into a false sense of security. The Rumanian defenders would not seriously threaten a determined force. A low level attack would give us the element of surprise. There was a good chance that a single lightning strike with a force of nearly 200 heavy bombers would take out Ploesti. All this optimism was based on the premise that the defenses at Ploesti had not changed. This faulty judgment gave small credit to a brilliant air tactician, Luftwaffe General Alfred Gerstenberg.

HALPRO had shown that the Americans had a serious interest in the Rumanian oil refineries. In answer to this interest, Gerstenberg had some of the finest pilots of the Luftwaffe brought into the Ploesti area. Crack anti-aircraft gun crews bolstered the defenses. The "second-rate" Rumanian flyers, over half of the interceptor force, were as good as any of their German allies.

And so, in July 1943, as the 9th Air Force prepared for Operation "Tidal Wave," the opposing sides held totally different views. The Germans, anticipating the flight, had beefed up for the battle that had to come. The Americans, remembering the first raid, HALPRO, thought they would be flying against a lightly defended target. On the first of August, 1943, one of the most terrible battles in the history of airwar was joined.

The five bomb groups of the strike force took off from fields in Libya. The lead group, the 376th totalling 29 heavy bombers, carried the mission commander, Brigadier General Uzel G. Ent and the lead



Model of Ploesti, scale 1: 5,000, was built in England in one week by the RAF, shipped to North Africa along with other models and carried from field to field by truck so that crews could familiarize themselves with it.

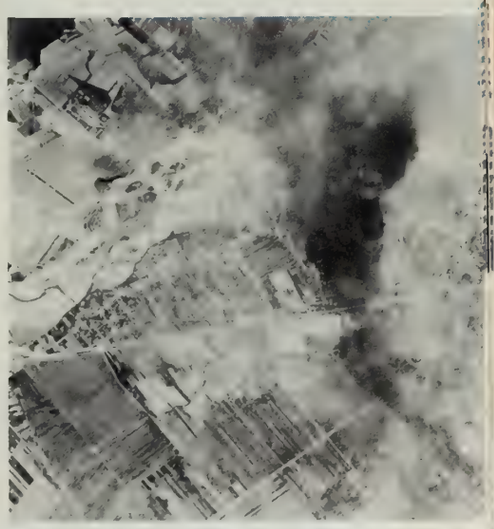
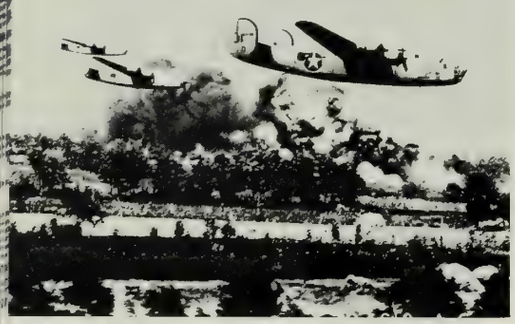


Photo of same area covered by model above. For orientation, key on the river in upper left of model photo and middle left in lower photo.

We wish to gratefully acknowledge the Air Force Museum at Wright-Patterson AFB, Ohio, for providing the photographs accompanying this article.

PLOESTI continued

Photo shows low level flown by raiders. Aerial gunners dueled with enemy flak batteries.



navigator, 1st Lieutenant Robert Wilson. With the "Liberandos" airborne, the 39 ships of the "Traveling Circus" followed. Behind the 93rd Group came the 47 "Pyramiders" of Killer Kane's 98th Bomb Group, Johnson's 37 "Eight Balls" of the 44th and in trail, the smallest group, the "Sky Scorpions" of Wood's 389th Bomb Group numbering 26 ships.

Only one plane was lost during the takeoffs but during the race across the Med, ten others of the force aborted and turned back to base. Then fate put her hand in. Without warning and without breaking radio silence, "WINGO WANGO," porpoised twice and plummeted into the sea taking the lead navigator, Wilson to his death. Another '24 spiraled down over the site in a vain search for survivors. There were none. Too late, the rescuing plane realized that it could not climb back to formation and it too aborted. Aboard that plane was the Deputy Mission Navigator.

A new plane slid into position as leader for the lead group. A young and inexperienced lieutenant suddenly had the responsibility of mission navigator thrust upon him.

As the force raced toward Rumania, they climbed to cross the Pindus mountains that rose 9,000 feet. The weather above them stacked clouds up to 17,000 feet. Again, fate stepped in.

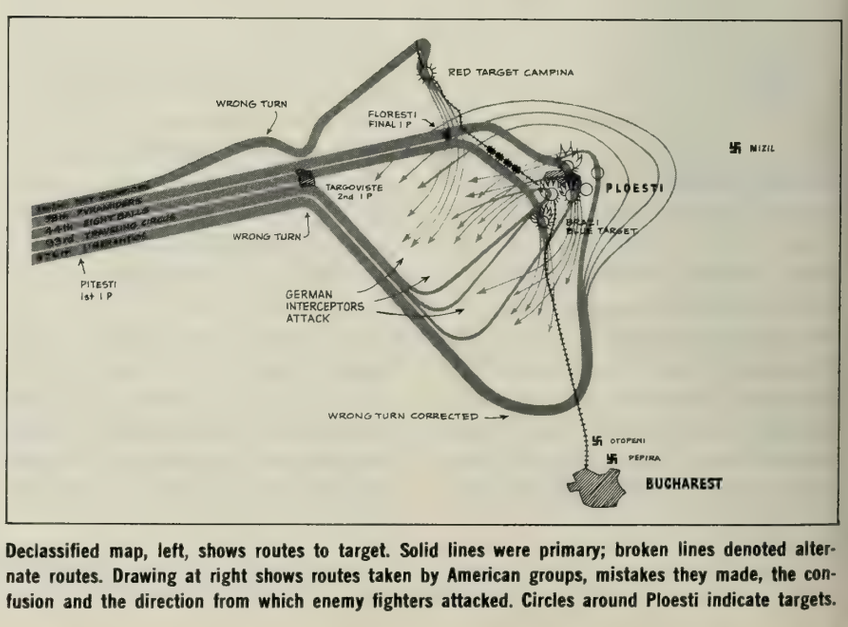
The first two groups made the penetration at 16,000. The other groups entered the clouds at 12. At the higher altitude there was a tailwind. Four thousand feet below, the groups bucked headwinds. Flight integrity was lost and the bomber stream was split. They never regrouped.

The Ops Order set Pitesti, 65 miles west of the target as the first IP. Beyond that lay Targoviste, the second IP. The groups were to turn on the final IP, Floresti, and make the 13 mile run southeast to the target. Ahead of schedule the lead group approached Targoviste. At the low bombing altitude, the ground and its landmarks streaked by too fast for recognition.

Over Targoviste, the second IP, the lead group commander, Colonel Keith Compton, suddenly ordered his pilot to turn. The pilot obeyed taking up the heading for the bomb-run. The acting mission navigator in another plane, knowing that they were only over the second IP, stayed on course and continued as briefed —alone.

Other pilots who realized that their leader had turned short were boxed in and forced to make the





Declassified map, left, shows routes to target. Solid lines were primary; broken lines denoted alternate routes. Drawing at right shows routes taken by American groups, mistakes they made, the confusion and the direction from which enemy fighters attacked. Circles around Ploesti indicate targets.

turn rather than risk collision. Twenty miles short of the planned turn, the 376th and 93rd Groups began a run on Bucharest . . . Gerstenberg's Fighter Control and Air Defense Headquarters and the heaviest flak concentration in Europe.

Too late, pilots broke radio silence; "Not here! Not here! This isn't it!" and "Mistake! Mistake" Still the bomber stream raced on.

The German defenses were confused. Not about what to do, but confused as to what the Americans were doing. The only target worth the effort was Ploesti. Why the invaders were threatening Bucharest baffled the Germans. Gerstenberg scrambled the defenses in the entire area. Hundreds of German and Rumanian fighter pilots rose to the attack. Nearly 240 heavy AA guns and hundreds more light guns came up on the line.

As they plunged on, Addison Baker wheeled his 93rd Group to the left stabbing straight for Ploesti. His plane "HELL'S WENCH" took an 88 blast in the nose and although ablaze, held straight and level leading his "Traveling Circus" to the target. Having done his job, Baker's plane heeled over and slammed into the ground.

When Compton's "Liberandos" finally turned to the attack, they made their run in from the south, the most heavily defended direction.

The three trailing groups flew the mission as briefed turning southeast on Floresti. The element of surprise was gone. German flak and fighters were ready and waiting. As Kane's "Pyramiders" and Johnson's "Eightballs" bracketed the railroad tracks between Floresti and the target, another Gerstenberg surprise came up. A special train, a flak train, paralleled the course of the low flying planes and hammered at them, downing or crippling bombers on each side of the tracks.

The well rehearsed and carefully planned mission came apart in the burning skies above the refineries. Instead of the orderly flight path that had been briefed, the three separated groups were converging on each other as well as the target. In the confusion, the groups had to seek targets of opportunity rather than the assigned ones. They flew into the smoke with the delayed action bombs of preceding waves going off in front of them and below them. Through all the tortured hell of the bomb run itself, German flak batteries and aerial gunners in the American bombers fired nearly point blank at each other. German and Rumanian fighters carved through the American formations filling the skies with parachutes, junk and death.

Their bombs gone "Tidal Wave" turned for home. Enemy fighters kept up the relentless pursuit, seeking out the cripples and sending them cartwheeling into the Mediterranean.

Twelve hours after takeoff, what was left of the strike force returned to base. Of the 164 planes that had gotten to the target, 110 made it back. More than 70 of those were no longer flyable.

Of the 1700 crewmembers that had flown against Ploesti, nearly a third of that number were dead, wounded, missing or captured before the day ended.

Militarily, it was a disaster. We were too badly hurt to go back . . . not right away. German oil production was not seriously hampered. Within six months, slave laborers had the plants back to cracking capacity.

It was a hairy mission . . . possibly the worst ever flown by American airmen. It did something good, however, for the young Air Force. It established a tradition that we have lived with ever since. No mission of the United States Air Force has ever been turned back because of enemy action. No better testament to courage can be offered. ★





Raiders flew from bases in North Africa, above, nearly 1,000 miles to bomb Rumanian oil fields and refineries shown at right.



Luckless Liberator. Middle B-24, aflame, probably went down. Photo, which must have been taken by someone in the formation, had no information on it.



FEEDBACK and USAF Accident Board Recommendations

MAJOR T. R. ALLOCCA, Directorate of Aerospace Safety

The Air Force annually expends a significant amount of effort, material and funds to enhance flight safety in support of its philosophy that accidents constitute a needless waste of human and material resources which can and must be prevented. Towards this end, accident investigation boards diligently pursue their dual objectives of finding out exactly what happened and then prescribing remedies to insure the problem is not repeated. Are they successful? That is, do we pay heed to their well thought-out recommendations and act upon them? This is not an easily-answered question, but the concept of "feedback" may prove helpful as we search for an answer.

Feedback. Originally popularized by Norbert Weiner in his book, *Cybernetics,* the term refers to the ability of a control system—involving either man, machine or some combination of both—to detect an error from what is desired in an operation and "feedback" that error to a control mechanism which then makes the necessary correction.

Now if we in the Air Force accident prevention business (and that's all of us), have this "feedback" concept down pat the process should go something like this: A mishap occurrs; the board analyzes all facets of the accident; the board publishes its findings and recommendations; the findings and recommendations are validated; the agreed-to recommendations are acted upon and a "large part" of the original problem is corrected. Sounds like a piece of cake, doesn't it? And we've really got it wired, haven't we?

Let's look at some recent accident history to see how wired we've got it. (Note: In the following cases, a broad "problem area" is presented, a recent mishap manifestation of this problem area is discussed and some past occurrences are presented. The accidents discussed in the 1972-1975 time frame are by no means the only "problem area" mishaps experienced; rather, they have been chosen from USAF's data bank for illustrative purposes only.)

Failure to Correct a Known System Deficiency (Fire Warning/Suppression Systems)

The full consequences of a February 1976 major accident may well have been avoided if the aircraft had been equipped with a "quality" fire warning/suppression system. From 1972 through 1975, five accident boards investigating mishaps involving aircraft as dissimilar as the T-38 and B-52 made recommendations to improve the fire warning/suppression systems. Yet in these five cases, the recommendations have not been "closed."

Failure to Implement Corrective Action which would Rectify a Known System Deficiency (Hydraulic Fluid Flammability)

Thus far in 1976, USAF has experienced two major accidents in which hydraulic fluid flammability has aggravated the accident sequence. From 1973 through 1975, we had 10 accidents, the full consequences of which may well have been avoided if USAF had adopted a less flammable hydraulic fluid for use fleet-wide. In each of these 10 accidents, the accident board highlighted the fact that hydraulic fluid flammability contributed to the accident and made recommendations designed to correct the problem. These recommendations are "open."



System with a Long History of Failure (Landing Gear).

We experienced three landing gear-related major accidents in March 1976. In each case the landing gear system had a known record of unreliability. In six accidents occurring between 1972 and 1975 involving aircraft as diverse as the F-105 and C-141, the accident board advanced recommendations aimed at improving known landing gear system problems. In these six instances, the recommendations have not been fully accomplished.

Tech Data Deficiencies.

In January we had a major accident in which tech data deficiencies may have contributed to the accident sequence. Accident boards investigating six mishaps in the 1974-75 time period made recommendations designed to improve tech data deficiencies. These recommendations, involving a myriad of USAF aircraft, are "open."

Training Deficiencies (Manuals, Directives).

A major accident which occurred in February 1976, involved a pilot attempting to execute a maneuver he had never performed as a rated crew member. He was unable to successfully accomplish the maneuver and the aircraft was destroyed. During 1974-1975, four accident boards addressed the area of training deficiencies and recommended that USAF make a concerted effort and collectively address the "training deficiency" problem area. The recommendation of these four accident boards is "open."

Feedback. In one of its simplest "real-world" uses—the thermostatically-controlled home heating system—we find an almost perfect application of the concept. But this is a simple, easy-to-control, mechanical, closed-loop system. Unfortunately, when we attempt to apply this cybernetically-derived idea to the functionings of government agencies and commercial enterprises, it is difficult to get a neat "fit" and a well-oiled and smoothly running system.

For this and other reasons, it would be foolish to suggest that when an accident board recommends, for instance, that USAF procure a less flammable hydraulic fluid, we should expect an immediate response. In such broad areas, we must expect that studies will be made, ideas submitted and opinions evaluated.

Against these bureaucratic exigencies, it is equally imperative to realize that when an accident board recommends a specific course of action, they do so only after they've made an exhaustive analysis and careful evaluation of the possible courses of action which will remedy the situation which caused the accident. Let's not lose sight of this very crucial point — that when an accident board undertakes its proceedings, USAF expects some strong, valid recommendations which will prevent recurrence of the mishap. When we allow bureaucratic problems to delay our response to their recommendations, we do them a gross disservice.

USAF's accident philosophy — that accidents constitute a needless waste of human and material resources which can and must be prevented—deserves our complete support. As an integral part of that support, we must master the concept of feedback. ★



MR. GORDON S. TAYLOR, Directorate of Aerospace Safety

With the advent of the dune buggy, dirt bikes, and increased numbers of outdoor enthusiasts, vast open spaces such as weapons ranges become more and more vulnerable to invasion by unauthorized persons. As spring and summer seasons approach, intentional and unintentional trespassing will substantially increase.

The intruders are usually unaware or unconcerned about the potentially lethal hazards, and the Government is vulnerable to litigation as a result of death or injury occurring to the trespassers. During the past few weeks of gunnery missions on day tactical ranges in Southern California it has been noted that there is a substantial increase in the number of unauthorized people on and around these restricted military areas.

During winter months, range trespassing diminishes, and the pilot may be lulled into a false sense of security. With the spring and summer increase in outdoor activity, pilots have to be extra cautious prior to accomplishing a firing mission to ensure that trespassers are not in the area. This hazard should be brought to the attention of all aircrews and repeatedly emphasized. Proper and thorough target observation must be continuous if we are to avoid a disastrous situation. The following actions are recommended:

- Immediate and repeated notification to all aircrews utilizing weapons ranges that the problem exists and can be expected to increase.
- Review of local policies and procedures concerning range clearing procedures. This includes periodic ground clearing of explosives and munitions residue as required by AFM 50-46 and aerial surveillance just prior to airborne missions. Definite procedures to be followed in the event of noted unauthorized trespassing should be established and understood by all concerned.
- Frequent checks of all access roads and range perimeters for adequate fences, gates, postings, and warnings.
- Publicity in local newspapers to refresh public awareness of the hazards of unauthorized entry into restricted areas.
- Creation of a quick reaction (helicopter if possible) force to apprehend trespassers.
- Command emphasis on range controls and conditions, with evaluation to be made during each unit inspection.
- Review of Command Regulations governing weapons range management, control, clean up, and security, with updating as necessary. ★

The Acoustical Pinger

MAJOR TONY HELBLING, JR.
Directorate of Aerospace Safety

There are not very many significant modifications you can make to a modern day F-4, C-5 or F-111 for a total of $173.00. Especially, if this device could pinpoint a lost aircraft 28 days after it crashed and sank under 12,000 feet of water!

As of this printing, some USAF aircraft and all International Carriers have been modified with this device. The FAA requires that all aircraft required to have a flight recorder also have a pinger on the recorder . . . so it can be located.

The pinger is a small device 4 inches long, weighs 9 ounces, and is about the size of a roll of quarters. It is powered by a replaceable battery with an installation life of one year (if not actuated sooner). The pinger is activated by contact with fresh or salt water. Once activated, it will transmit for 30 days continuously. It transmits on 10 or 37 hertz depending on the model. The international acoustical common is 37 hertz. Several fixed or portable receivers with directional capability are available for signal tracking.

For certain missions, a pinger-equipped aircraft may not be tactically feasible. Under these conditions, the unit can be disconnected with two wing nuts in a few minutes. The unit should be mounted in a moisture free compartment. The aircraft structure will not inhibit signal radiation.

The employment of this device is currently being reviewed. It will be installed in specified USAF aircraft in the near future. Certain test aircraft such as the B-1 already have been modified. The pinger has several other applications and has successfully documented its existence with Navy operations and the FAA.

According to a previous article in the May 1975 US Navy *Approach* magazine, the following tale documents its effectiveness. In 1972 the Naval Test Center lost a valuable F-4 test aircraft during a mission over water. The aircraft crashed at 1400. The search was initiated at 1500 in a Navy crash boat. Upon arrival in the general search area, debris was noted floating in a 4 square mile area. A portable hydrophone device was dipped into the water and pinger signal was received. The signal source direction was determined by rotating the hydrophone until maximum audio signal was obtained. The signal was tracked by stopping the boat every 300 meters and submerging the hydrophone. After tracking for 1½ miles, the signal source reversed 180\ degrees, indicating wreckage passage. A Navy diver slipped into the water with the portable hydrophone unit. The underwater visibility was less than one foot. The diver traveled about 100 meters before "bumping" into the wreckage. The total search time was 95 minutes.

More sophisticated search techniques would be employed in deeper waters. The low relative cost of the unit has enabled its installation on practice torpedoes and mines. It has also been employed on spacecraft nosecones, etc. In 1974, the pinger pinpointed a lost TWA 707 which crashed off the coast of Greece in 11,000 feet of water.

There is no doubt that the acoustical locator could make the difference between a known cause factor versus an undertermined accident. This device should prove a valuable asset in future USAF search and investigative efforts.

. . . PING! ★



THE IFC APPROACH

A recent major aircraft accident which resulted in three fatalities, has highlighted, once again, the potential dangers of circling approaches. The complexity of this maneuver cannot be overemphasized. Consider the circumstances under which you last performed a circling approach at a strange field. In fact, if you've ever performed this maneuver at a strange field, you're probably in the minority. It's a hard fact that most Air Force pilots seldom have a need to fly a circling approach. However, if and when that day comes, you've got to be ready because you won't have time to practice.

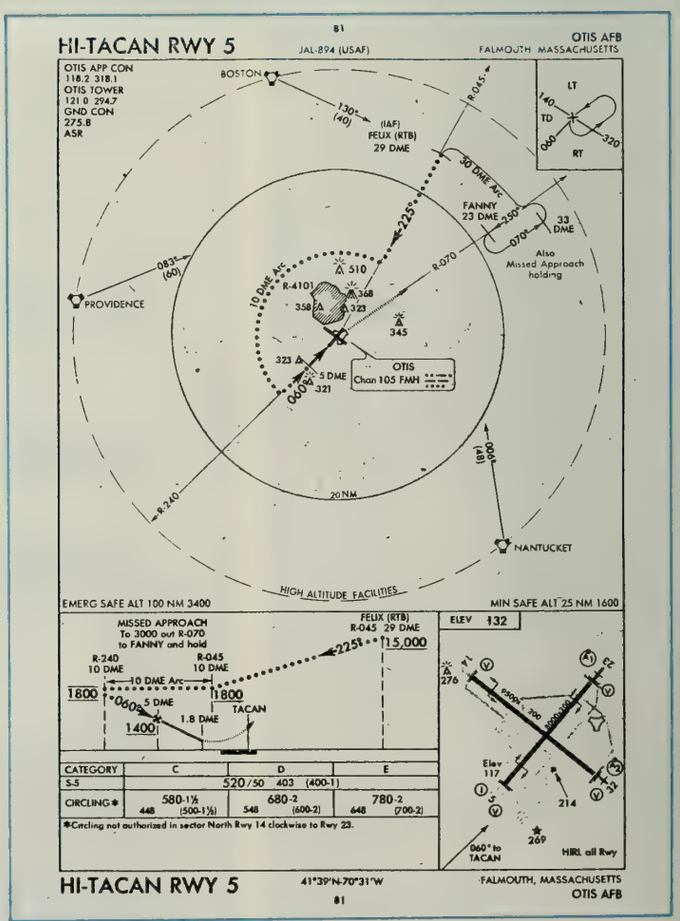
What makes a circling approach so difficult? You've aligned your aircraft with a runway many times before and this should be no different—or should it? Consider the fact that you will be transitioning from instrument flying to visual flying—not just to land the aircraft, but possibly to perform some extensive maneuvering prior to landing. Additionally, if you are at circling MDA, you will normally be lower than your visual traffic pattern altitude. Combine all this with the fact that (1) you may be flying slower than normal visual pattern airspeeds, (2) the runway arrangement may be confusing if you're at a strange field, (3) the weather may be at or near circling minimums, and (4) local restrictions may prevent flight over certain parts of the aerodrome. You can see that the circling maneuver becomes considerably more difficult than a normal visual pattern.

Let's look at some techniques to prepare for the circling maneuver and increase the margin of safety as much as possible. Forecast winds are a good starting point. A clue that you may have to execute a circling approach is a wind favoring the use of a runway without a useable instrument approach.

The forecast ceiling indicates the altitude that you may be using in the maneuver. Remember that circling minimums are just that—minimums. Nothing prevents you from flying higher. If the ceiling allows it, fly an altitude that more nearly approximates your VFR traffic pattern altitude. This will make any maneuvering safer and bring your view of the landing runway into a more normal perspective.

A review of the instrument approach procedure chart during flight planning will reveal any restrictions to circling. A restriction that affects the direction of the base turn would be an important consideration in side-by-side cockpits because the runway may not be visible from the seat of the pilot flying the approach. Look at the approach in Figure 1. In this example circling is prohibited in the northern quadrant of the airfield. If you fly the TACAN approach to runway 5, the direction of your base turn will depend on the runway to which you circle. For example, a circle to runway 14 would require a right base turn whereas a circle to runway 23 would mean a left base turn. In-flight is where the pilot may have to determine exactly how the maneuver will be performed. However, thoughtful preflight planning will reduce the amount of in-flight mental calculations.

FIGURE 1



By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

The infinite variety of circling maneuvers cannot possibly be covered here, but let's discuss three of the more common types. The techniques used are adaptable to most circling maneuvers.

Remember, in all these maneuvers, the wind can have a significant effect on your displacement and must be considered. A wind that blows you away from the runway would result in an angling final and you could exceed the limits of the design circling approach area. More importantly, a wind pushing you toward the runway could cause an overshoot; one of the major causes of circling approach accidents.

a. The 180° MANEUVER: In this situation, you are cleared for an approach to one runway and cleared to land in the opposite direction. In the example shown in Figures 2, 3, and 4, we have been cleared for an instrument approach to runway 36, circle to land on runway 18. The task is to maneuver our aircraft to the position marked with an "X". At that point we can initiate a base turn to runway 18, using normal bank angles, to roll out aligned with the runway. Of course, the position of this "X" will vary for different aircraft or even the same aircraft at different weights and speeds. One way to determine displacement is by consulting the "General Turning Performance" chart in AFM 51-37. For the sake of our example let's assume we need 1.5 NM displacement from the runway to execute our turn.

One technique, as shown in Figure 2, would be to turn at a 45° angle and fly down the length of the runway a distance equal to your desired offset; then turn to parallel the runway. Geometrically, you have described a no wind triangle with two equal sides. This technique reduces the amount of guesswork needed to laterally displace your aircraft. It also allows you to keep the runway environment in sight. The drawback, of course, is that you may need to displace yourself at a distance greater than the length of the runway. In this situation you could add overruns and approach lights to the runway length, so as to achieve the proper offset.

A second technique, shown in Figure 3, is to turn at a 60° angle and fly a distance equal to approximately 2/3 your required offset; then turn to parallel the runway. In this case you would travel approximately 1 mile down the length of the runway to displace yourself 1.5 miles. The advantage of this technique is that you fly a shorter time and distance to obtain the same lateral displacement. It gives you more time to correct for winds on downwind. The disadvantage is that

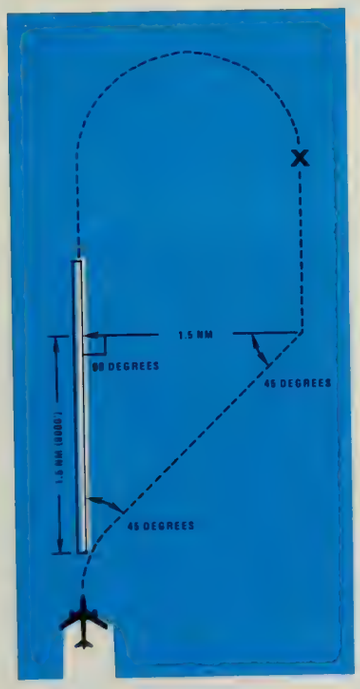


FIGURE 2

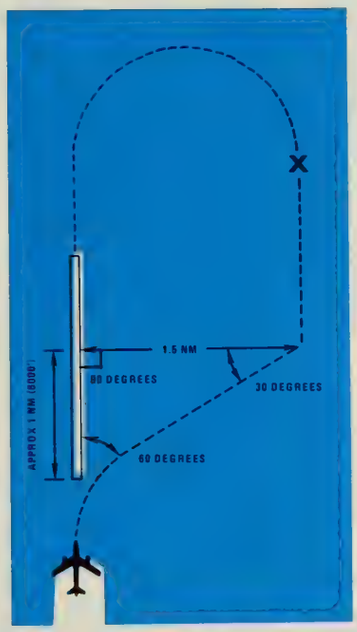


FIGURE 3

it may be difficult to keep the runway environment in sight.

If you don't like either of these techniques, consider making two 90° turns as shown in Figure 4. These two turns should give you the displacement necessary for your 180° base turn if the crosswind component is not a factor. While this technique reduces the need for any mental computations on the part of the pilot, it makes it even more difficult to keep the runway environment in sight during the initial part of the maneuver.

IFC continued

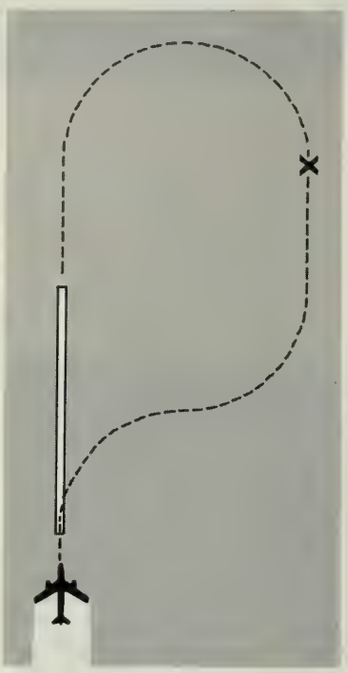


FIGURE 4

b. 90° MANEUVER. The second situation to consider is approaching the landing runway at approximately 90° as shown in Figure 5. Again, our problem is to displace ourselves far enough to allow for a normal base turn. Since our turn to a downwind heading will give us approximately half our required offset (180 degrees vs 90 degree turn), we have only to delay that turn to downwind until we have flown a sufficient distance to cover the other half. If we have a ground speed of 180 knots (3 miles per minute) and want a ¾ mile flyoff (half the 1.5 mile turn diameter), we could time for 15 seconds when overhead the runway, then start our turn to downwind. Different airspeeds and turn radii will require different flyoff times. You should determine one that will work for your aircraft. As with other techniques, be sure to consider the wind.

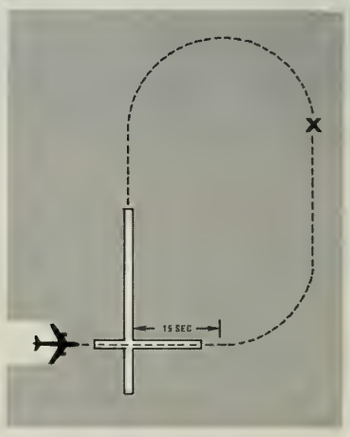


FIGURE 5

c. 360° MANEUVER: This maneuver is useful when dropping off a wingman if you can't make a formation landing, or at any other time when you can't land out of a straight in approach. Here the technique for displacing yourself is somewhat easier. The 180° turn to downwind, as shown in Figure 6, should give you adequate displacement in a no-wind condition. If winds are a factor, vary your bank angle in the turn or use a heading correction on downwind.

As you can see, all of the techniques discussed so far have been designed to give the displacement necessary to prevent overshoots or tight base turns. There is, however, one final point to consider. Starting the base turn abeam the runway threshold would probably result in little, if any, time on final. This would not allow you to make additional configuration changes and/or obtain the desired final airspeed. Therefore, plan your turn to give you the needed distance on final. Here, as in some of the above techniques, a knowledge of your groundspeed can be used to time your flight from the abeam position to a point where you want to begin the base turn. If your ground speed is 180 knots and you want a one mile final to fly the maneuver in Figure 6, time for 20 seconds and start the base turn. (No Wind).

So there you have it. These are a few techniques (NOTE: I said techniques, not procedures) which we have found useful. While they cover only three specific situations, a little imagination on your part is all that is necessary to modify them for use with a wide range of circling maneuvers. Remember that these techniques were designed to help you align with the landing runway. If you still find yourself in a position that would require tight turns for alignment, don't be too proud to go around. Finally, don't wait until you have to fly a bona fide circling approach to try these techniques. Practice them in good weather and light traffic. A little practice will go a long way toward preparing for the "real thing." ★

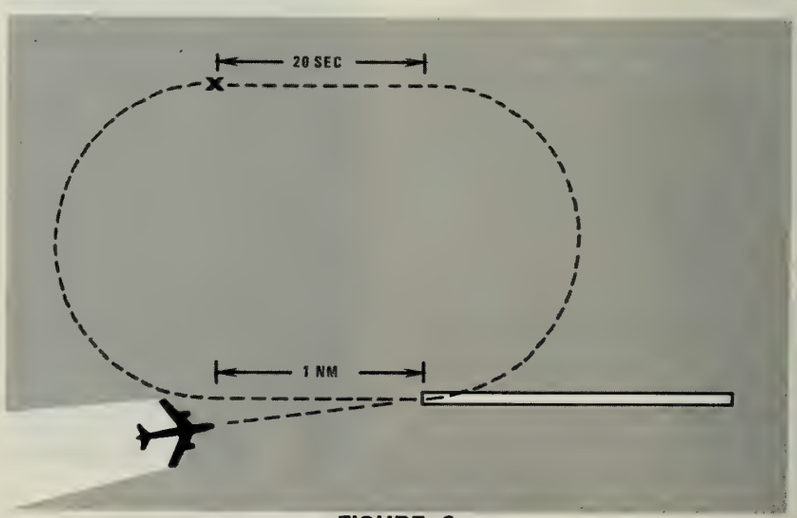


FIGURE 6



MARK HUNTER

REX RILEY
Transient Services Awar

Have you ever wondered if anyone cares about the kind of service you get as a transient aircrew? Well, someone does care. In fact a lot of "someones" care, from the base commander on down.

That is why the Directorate of Aerospace Safety in 1958 established a special award to recognize bases which provide outstanding transient services to aircrews. The Rex Riley program is administered by the staff of *Maintenance* magazine and the personnel of the Directorate of Aerospace Safety. A base is considered for the Rex Riley Award when the editor of *Maintenance* has received three or four letters from transient aircrews indicating that services at that particular base are outstanding.

This is where you participate in the program. As you travel to various bases, let the base and the people at AFISC know about the quality of the service you receive. If you have a problem, it can then be fixed or if the people did a good job they can be recognized.

Once the base is placed on the "to be considered" list, a Rex Riley evaluation team will visit and make a recommendation on whether the base merits the award. The final approval for the award rests with the Director of Aerospace Safety.

The Rex Riley evaluation team will visit the base unannounced. They want to see what the service is like on a day-to-day basis. The team will look at the quarters and messing facilities, evaluate base operations, weather and the tower; but what they are really interested in is maintenance. The team will take a really critical look at transient alert. They want to know how well the TA folks are prepared for transient traffic. The team includes maintenance men who will watch servicing and preparation of the aircraft. Other team members will check on the availability of specialists and supply support. Once they have looked over the whole operation, the team will make a recommendation.

Sometimes a base that has been on the Rex List is removed for one of several reasons. The quickest is for a base to be responsible through haphazard servicing or maintenance for an accident or incident. Bases will also be removed if reports of a regression in the quality of service is verified by one of the Rex Riley teams. Or if a base is unable to provide all the services and facilities, it will be removed. This includes things like quarters, POL and normal maintenance support. That does not mean that every base should have specialists trained for each aircraft in the inventory. But there should be support available to clear up the more common transient problems that can affect safety—radios or instruments for example.

If a base is selected as a "recommended" base, the commander will be notified by letter from the Director of Aerospace Safety. In addition, the base will receive a transient services award certificate and transient alert personnel will be authorized to wear a special award patch on their uniforms. ★

REESE AFB
Lubbock, TX

VANCE AFB
Enid, OK

LORING AFB	Limestone, ME
McCLELLAN AFB	Sacramento, CA
MAXWELL AFB	Montgomery, AL
SCOTT AFB	Belleville, IL
McCHORD AFB	Tacoma, WA
MYRTLE BEACH AFB	Myrtle Beach, SC
EGLIN AFB	Valparaiso, FL
MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
MARCH AFB	Riverside, CA
GRISSOM AFB	Peru, IN
CANNON AFB	Clovis, NM
LUKE AFB	Phoenix, AZ
RANDOLPH AFB	San Antonio, TX
ROBINS AFB	Warner Robins, GA
HILL AFB	Ogden, UT
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, NC
ENGLAND AFB	Alexandria, LA
KADENA AB	Okinawa
ELMENDORF AFB	Anchorage, AL
PETERSON FIELD	Colorado Springs, C
RAMSTEIN AB	Germany
SHAW AFB	Sumter, SC
LITTLE ROCK AFB	Jacksonville, AR
TORREJON AB	Spain
TYNDALL AFB	Panama City, FL
OFFUTT AFB	Omaha, NE
McCONNELL AFB	Wichita, KS
NORTON AFB	San Bernardino, CA
BARKSDALE AFB	Shreveport, LA
KIRTLAND AFB	Albuquerque, NM
BUCKLEY ANG BASE	Aurora, CO
RICHARDS-GEBAUR AFB	Grandview, MO
RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH
CARSWELL AFB	Ft. Worth, TX
HOMESTEAD AFB	Homestead, FL
POPE AFB	Fayetteville, NC
TINKER AFB	Oklahoma City, OK
DOVER AFB	Dover, DE
GRIFFIS AFB	Rome, NY
KI SAWYER AFB	Gwinn, MI



TIME BOMB

CAPT ALLAN R. SWEENY, 307 TFS, Homestead AFB FL

TICK-TICK-TICK-TICK-TICK-TICK-RRRRRINNNNGGGG!

The alarm clock jolted him out of his semi-consciousness and the fighter pilot knew that he had to leave his dream world and face the reality of the day. Easing himself over the side of the bed he noted that the weekend would be a welcome respite from these five extraordinary days of operations hassle. He also reflected briefly that, having spent most of his flying career in combat, he was still trying to adjust to the changing priorities of peacetime that seemed to overlook getting the job done. These were private thoughts and he still kept them to himself. TICK.

But today he did have a job to do and was looking forward to leading his flight on a familiar bombing and gunnery mission—until he looked out the window. Yesterday's cold, penetrating drizzle was hanging on and he hated the weather hassle more than anything. TICK.

Undeterred, he completed his preparations for the day's work and headed for the ops building. His career had been a rewarding one. He considered himself fortunate to have gained so much experience so quickly. Although a young captain, he had accumulated hundreds of hours of combat time in a variety of stimulating and satisfying missions. Even more important to him was the fact that he had often been entrusted to lead some of the more demanding ones. Much of the satisfaction he gained was from accomplishing those tasks in his own way. He felt good under the pressure of responsibility and had been glad that he was given complete control and flexibility as a mission leader to get the job done.

The weather that had seemed to be lifting on his way to work was confirmed in the day's forecast. The range weather should permit all the required gunnery events, ceiling and visibility were gradually improving, and by the time they were due to return would probably permit VFR recovery.

His flight briefing was smooth, concise, and detailed. His wingman would be another of the more experienced pilots with whom he had often flown. In spite of the VFR weather forecast, he remembered to brief the new IFR recovery procedure. It was the third change in six months, and this time it appeared to be the only one he could use in IFR conditions. What a pain, he thought, to have to put up with all these changes. TICK.

They waited briefly for the wingman to get an aircraft assigned, then headed for the flight line. Engine covers on, downlocks on, canopies closed, starting units not in place. *Typical maintenance again,* he thought. *The crew chiefs are good, but if I had some control over them they might be on time.* TICK.

Eventually they were airborne and in the element he enjoyed: Confidently leading a flight with a trustworthy, reliable wingman. He knew that he could contend with any problem and that his wingman would be there to support him and to take over if he so decided.

Inbound to the range they switched to primary frequency, then to the secondary, then back to primary without reply. The hiss and loud squeal in the radio, a product of poor design and moisture, was no help. It was becoming just plain infuriating. TICK.

With patience, though, contact was made and he calmly covered the required items with range control including the desired events and a request for the latest observation. He almost could have figured it. The weather was still too poor to complete all they had set out to accomplish. *Those weathermen,* he thought, *I can never trust them to give a reliable forecast.* TICK.

Thanks to his briefing they could still proceed with the alternate mission. This they did in spite of the worsening weather, various communications problems, additional pattern restrictions, and a new range officer not totally familiar with procedures. It was a challenge, but he was actually becoming more confident as he successfully overcame each problem. This was his training and experience and he knew he could cope with it all. He was in control and making decisions on his own.

The gunnery completed, they joined up, switched to center, and got clearance direct to home plate initial approach fix. He would like to have received an enroute vector without going out of the way, but this was the new recovery procedure. As they leveled off, Center passed the latest weather observation. *Oh, that is frustrating,* he thought. *Not only is the latest observation 45 minutes old, but it is far worse than what was forecast.* TICK.

Now he set a new bingo, reminded his wingman they would recover in formation but to be prepared to go separately if the weather got worse. Just as he reduced power to a more efficient fuel flow he heard Center pass them to the approach control frequency and direct a descent. He should not accept a descent this far out to so low an altitude because of the narrowing limits of his fuel situation. "Unable descent at this time, Center." But he got no response. *That's typical,* he thought. *They leave you hanging as soon as they can pass off their responsibility.* TICK.

They began a slow descent and switched to Approach Control. As they entered thick clouds the radios started their hiss and crackling, and Approach's transmissions became very distorted. TICK.

He confirmed his altitude and requested an update on the field weather. No response. After several attempts without success they returned to Center frequency. Again there was no response. They returned to Approach Control for a radio check. "Loud and clear," came their reply. And this time they confirmed the altitude. Again he asked for a weather update. No response. TICK.

They were coming up on an extended line of the final approach course, still in clouds in formation when Approach Control passed to them a completely unexpected and inconsistent vector for the situation. To comply would further restrict his options under the weather and fuel state.

"Approach, say again the heading for us," he asked, hoping to prod them into recognizing the error. No response.

"How do you read, Approach?"

"Loud and clear," came the reply.

"Approach, say again the heading for us."

No response. TICK.

Now he had no choice but to take the vector. Fuel was the only concern; terrain was no factor, and other traffic did not use the airspace they were entering. He could cope with it, but he was having doubts about the approach controller. TICK.

It had been 5 minutes since he had last requested a weather update and now, suddenly, Approach passed it to them! It was not suitable for a formation recovery, but he was not

TIME BOMB continued

going to let his wingman loose so far from the base under such uncertain conditions. They were still on the incorrect heading. He asked for a radio check. "Loud and clear," came their reply. So they did hear him. He quickly informed them of his position and asked for a new heading. No response. TICK.

"Maintain VFR, sir," said Approach. TICK.

"Unable, Approach. We are IMC requesting a new heading."

No response. TICK.

He could hear the controller passing information and direction to other flights in the pattern. "Is Approach losing control?" He thought. "Can they be so inflexible to the new procedures?" TICK.

"How do you read me, Approach?"

"Loud and clear, sir. Maintain altitude."

"Roger, give us a new heading." No response. TICK. Minutes of silence. No response. TICK.

"Give us a heading, Approach!" No response. TICK.

No response. No response. No response. TICK. TICK. TICK.

That was all he could take. Mashing down the mike button and tightening his grip on the control stick and throttles he bellowed into his mask, "Approach, we are in formation, IMC, heading away from the field, at low altitude, and we want a heading to the field, we want separate recoveries, we want full stop GCA approaches, we want you to wake up down there, turn on your scopes, listen to us, and do your job like we are doing it up here! We want some response, now!" RRRRRRINNNNNGGGG!

His outburst jolted him out of his state and the fighter pilot knew that he had to leave his emotion and face the reality of his position. Regaining some of his self control, he recognized that he was in no condition to continue as the flight lead. He passed the lead to his wingman so that he could calm down. Radio contact was soon reestablished and recovery accomplished with no further problems.

The next day the fighter pilot reflected on the incident. Why had he reacted so? Such immature behavior was not like him. The flight surgeon's reference books were in front of him and he searched for answers. He noted a paragraph on immature reaction to stress*. "Aggressiveness in the solution of problems is desirable behavior. On the other hand, aggression defined as 'destructive attacks' is an undesirable response. It is however, among the most frequent reactions to frustration of other stressful situations."

So it had happened even to him! He remembered also that Alvin Toffler had theorized in *Future Shock* that stress is often a result of the pressure of change. So he had not been able to modify his ingrained feelings to the peacetime situation in which he had to relinquish flexibility and control and depend more on the decisions of others. In combat he would have had more ways out of the same situation.

Another paragraph told him that "the distinguishing characteristic of either panic or rage is that it is uncontrollable." certainly he had been out of control for those few seconds. "The principle way emotion affects thinking is by narrowing, or 'channeling' attention." That is why he seemed to forget everything except that controller. Was there anything else? The book said that "gloom is a more prolonged emotional state." That week's operation could have added that emotion to yesterday's pressures. Environmental stress, it said, affects the mental stability of the pilot by exposing him "to frustrating situations resulting from weather conditions, traffic, the inadequacies of other persons . . ." *Almost an example of yesterday,* he thought.

He read well into the afternoon. The information would be good material to use at the next flying safety meeting. Learning to recognize his own symptoms to stress would be something to work on. He resolved to learn more on this subject of emotion, and to try and understand more about personality.

Ahead of him was a relaxing night at a quiet restaurant. His worries were subsiding and would soon be gone. Tomorrow the alarm would not go off. ★

*Bond, Nicholas A., Bryan, Glenn L., Rigney, Joseph W., and Warren, Neil D. AVIATION PSYCHOLOGY. Los Angeles: University of Southern California, 1968.

CONGRATULATIONS!



The 336th Tactical Fighter Squadron from Seymour Johnson AFB, N.C., completed an unprecedented eight accident-free years of flying while deployed to Bold Eagle '76 at Nellis AFB, Nevada. Commander Lt Col Jimmie V. Adams (center) was on hand to congratulate Maj Fred Luigs and Capt Gil Betz, whose flight passed the safety mark. (USAF Photo)

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Well Done Award

Presented for

outstanding airmanship

and professional

performance during

a hazardous situation

and for a

significant contribution

to the

United States Air Force

Accident Prevention

Program.



CAPTAIN ROY M. ALLEN

Detachment 18
39th Aerospace Rescue and Recovery Wing
Plattsburgh AFB, New York

On the night of 4 September 1975, Captain Allen and his crew had just completed an emergency medical evacuation mission which saved the life of a six-year-old auto accident victim. The child, suffering from a fractured skull, had been flown to a local hospital and the crew was returning to Plattsburgh AFB, NY. While on short final, at approximately 50 to 100 feet AGL, the crew heard and felt a loud explosion from the engine compartment of their UH-1N helicopter. This was followed by activation of both audio and visual low rpm warning signals. Sensing complete power loss, Captain Allen reacted instantly, lowered the collective, and entered autorotation. With decreasing rotor rpm, he successfully flew the helicopter to a slide landing on the taxiway, stopping it short of a parked KC-135 Stratotanker. Captain Allen then applied the rotor brake, turned off the battery, and directed his crew to evacuate. Subsequent investigation revealed that the power turbine of the nr one engine had disintegrated, causing the explosion. Fragments from the explosion pierced a titanium firewall and then penetrated the nr two engine, causing it to fail. Captain Allen's skill during the loss of both engines prevented injury or, possibly, loss of life and saved an aircraft. WELL DONE! ★



But honest, all I did was take an extra copy of Aerospace Safety!

The scene above is a bit overdone, but the point is that *Aerospace Safety* has changed with the publication of the new *Maintenance* magazine and Air Force distribution of *Lifeline*. Each magazine zeroes in on a specific audience and *Aerospace Safety* is for aircrews, their commanders and supervisors, and a few support people such as air traffic controllers, life support and survival personnel and flight surgeons.

Distribution is geared to this concept and funds are not available for general distribution as before *Maintenance* and *Lifeline*. We will supply as many as possible, but all units should order, through their PDO's, only the copies needed on a 1 for 10 basis in the intended audience. Thanks, the editor.

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SAFETY JULY 1976

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This Bicentennial period should be a time of great pride and optimism for Air Force people. Although our service history covers only a small portion of the nation's two hundred years, the accomplishments of your fellow airmen since 1947 have been monumental. The Berlin Airlift, the Korean conflict, the Cuban crisis, and the Vietnam war have displayed the Air Force's resiliency, adaptability, and courage.

Today, as we face the beginning of our nation's third century, the Air Force remains in the forefront of our national destiny. Air Force people have never been more intelligent or better trained. The new weapon systems now in development and production will insure that our people are equipped to meet future challenges.

However, strong and scrupulous adherence to uncompromising safety techniques will remain a vital element in all that we hope to accomplish. With our active duty forces now at the smallest size since before the Korean war and with the cost of weapon systems climbing to unprecedented levels, safety becomes an even more serious consideration. The nation needs our best efforts to avoid the needless loss of lives and equipment. We cannot afford preventable accidents and incidents.

Honorable Thomas C. Reed
Secretary of the Air Force

As we proudly celebrate this 200th anniversary of the founding of our country, we know that if we are to maintain the freedom for which the United States stands, we must remain strong.

As the first line of defense for this country, the Air Force must be ready to respond to the call of our leaders anytime, anywhere. But just as a Minuteman's broken musket put him out of action, so we are weakened today when one of our people or one of our weapons is damaged or destroyed by an accident. If all of us perform our jobs to the best, we will prevent those needless accidents that reduce our strength and jeopardize our ability to perform our mission.

I am proud of the Air Force's contributions to the freedom of our country as we keep the Air Force strong and always ready.

General David C. Jones
Chief of Staff, USAF

Life Support



DISCIPLINE

MAJOR WILLIAM D. HARRISON
Directorate of Aerospace Safety

If any of you fighter jocks (fighter-gators accepted) can remember your escapades during the SEA conflict, I would like for you to think back a minute. How many of you can remember leaving your G-suit in your locker when you went to fly that leisure mission to route PAC Six? How many of you pilots neglected to brief your GIB on ejection signals and procedures to follow if you had to get out of your aircraft in a hurry? I really don't think that any of you were guilty of these, or any such prior planning infractions, during the conflict, but what about now, when no one is shooting at us?

In 1975 we had our best ejection success rate yet, but a review of last year's ejection episodes indicates that many aircrews were very fortunate to survive their emergencies so successfully, since many of them were extremely ill prepared for their flight into the blue. Let's briefly take a look at a few of the predicaments some of our crews found themselves in.

- Pilot and WSO ejected into 50° water . . . no anti-exposure suits.
- Pilot lost electrical power on night mission . . . no flashlight.
- Pilot and WSO ejected successfully, but neither crew's survival radio carried in vest would function . . . malfunction would have been discovered if radio preflight had been accomplished.
- Pilot forced to eject over water . . . no life preserver worn.
- Aircrews on three separate occasions delayed inflating their life preservers until they were in the water . . . a violation of all training and good common sense.
- Three aircrews received damage to their anti-G suits . . . cause was unauthorized items carried in pockets.
- Two pilots unnecessarily extended their rescue and recovery time . . . locator beacons left on, thus blocking voice transmissions with rescue forces.

While it is true the aircrews involved in the above mishaps survived their episodes, they were extremely fortunate that all other factors were favorable. Change any of the ejection scenario and the results could have been drastically different.

Why don't aircrews take more interest in their life support squipment and training? The answer can have many facets. Some feel that such training is like "practice bleeding." Others feel that because they had it before there is no need to go through it again. But, most feel that accidents happen only to the other guy. Last year, 79 of those "other guys" were forced to eject; seven of them didn't make it. When one of the surviving crews was asked to explain the reason for his mistakes, he put it this way: "The aircrew will not seek this training or wear equipment that is forced upon him, and commanders are very reluctant to make these items mandatory."

Life support equipment and associated training is not "forced" on anyone. It is provided for only one purpose—to equip the aircrew for whatever unfortunate situation with which he may find himself confronted. Sometimes it is necessary for certain training and equipment to be a mandatory requirement, but this is done only when our "lessons learned" have pointed out the need for this action.

Most of the aircrews in favor of life support training and equipment are those who have found themselves in unfortunate situations and have put these items to good use. Now, who better to take our lead from than the guys who have been there?

Let's each of us life support types, officers and enlisted alike, look hard at what it takes to protect our aircrews and do all in our power to ensure their safe recovery from unpredictable situations. As aircrews, let's stand back and look realistically at what is provided for us. Life support equipment and training are our "insurance" and should not be taken lightly. We all pay into some sort of insurance programs, be it life, automobile, homeowners, or whatever. All are designed to provide one thing to the beneficiary—protection. Life support training does equally the same, and you can't beat the coverage or the premiums. ★



UNITED STATES AIR FORCE JULY 1976

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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JULY 1976 AFRP 127-2 VOLUME 32 NUMBER 7

the DEPTHS of DISTRACTION

LT COL ROBERT J. BRUN
Directorate of Aerospace Safety

All of us have had some experience with distractions and most everyone encounters several types—pleasant, annoying, or whatever—in the course of a day. Although these changes in mood are typically short lived, they often produce disastrous and decidedly long term results. A headliner in this category is the distraction-induced aircraft accident.

One of the first jumbo airliner losses was largely due to the cockpit distraction associated with a landing gear indicator problem. While orbiting at low altitude to troubleshoot the system, the pilots became preoccupied with this task and failed to detect a gradual descent which culminated in a tragic accident and the loss of 101 lives. Darkness, sparsely settled terrain with few to no nighttime references all contributed but the basic cause was failure to maintain altitude control.

A few months later a military transport crew had a very similar accident, only in this case there was a cockpit discussion questioning the safety of a descent clearance which was issued just prior to the crash. The investigation disclosed that the ATC transmission was misunderstood and when the crew read back an altitude 2000 feet lower than assigned, their transmission was blocked and the controller was, therefore, unaware of the misunderstanding. Reportedly, the lights of the city were clearly visible ahead while the unlighted hills below were not. This hastened the end of the terrain clearance discussion and the dissenting crewmember was assured everything was fine. A few seconds later the aircraft struck the ground and disintegrated. From the evidence available, it was concluded that a fully operational aircraft was flown into the ground by a highly qualified aircrew simply because of insufficient attention to standard procedures and the distraction furnished by the lights of their destination. There was one survivor out of the 25 people on board.

In a more recent example, a night takeoff accident involving a tanker with a basic crew, there were no survivors available to report details but distraction was clearly evident, as the investigation showed. It was extremely cold and a series of ground delays added frustration to the already formidable discomfort of the crew. Shortly after liftoff they reported the landing gear wouldn't retract and requested a turn to downwind for a system checkout. The turn was never completed and it is doubtful if the aircraft even reached traffic pattern altitude. Contrary to longstanding procedures, and most probably as the result of undue attention to the gear problem, the flaps were brought up and the aircraft was flown into a power-on stall which terminated in a fiery crash. No evidence was found to indicate an in-flight causative factor other than inattention to basic pilot duties.

The experience levels of the pilots involved in these examples ranged from many thousands of hours to less than 1500 total hours so it *can* happen to anyone—anyone who will let it happen. To sloganize, "Distraction Invites Destruction," so don't let this be said of your crew . . . they "DID" themselves in. ★



FROM WHENCE WE CAME

THE AIR FORCE STORY



MSGT DAVE SYLVA
63 MAW, Norton AFB CA

We wish to gratefully acknowledge the assistance of the Air Force Museum at Wright-Patterson AFB and all other contributors for the photos used with this article.

The mission of the Air Force is to fly and fight—but its motto is "Aerospace Power for Peace." Today's Air Force—the B-1 bomber and the F-15 Eagle—sleek jets streaking through the stratosphere at twice the speed of sound—global airlift. The tip of the spear of America's triad of defense. One of the most powerful forces ever conceived for war or peace. But it was not always so.

For the story of the Air Force is a story of tragic victory—of fools, daredevils and geniuses—of sacrifice and apathy—triumph and defeat—faith and betrayal. A story of giants and deeds never dreamt of in myths.

It is the story of the bicycle boys from Dayton, of Luke, Rickenbacker, Mitchell, Doolittle, Bong, Gabreski, McConnell and DeBellevue. Of Arnold, Spaatz, Vandenberg and Lemay.

It's the 1st Aero Squadron and the 94th "Hat in the Ring." The Tokyo Raiders and Kinney's Kids. The mighty 8th and Lemay's 20th. The bloody One Hundredth and Zempke's Wolfpack. The Grim Reapers of the 13th Bomb and the Gunfighters of Danang.

It's Kittyhawk, St. Mihiel, Kelly, Randolph and Clark Fields. The Bismarck Sea, Schweinfurt, Berlin and Tokyo, Templehof Tower, MIG Alley and the Red River Valley.

The story begins in 1903, on December 17th with the short hop of the Wright flyer from the sand dunes of Kittyhawk. Man's first powered flight, a feat that was acclaimed by all the world—except by the United States government.

Not until four years had passed were the first steps taken to catch up with the world. President Teddy Roosevelt ordered that an Aeronautical Division be created within the Signal Corps. Three men. Three men to staff the air arm.

When the first great World War began, the American air arm had 122 men in it and ranked 14th in world air power. But from the very beginning, it was clear that American flyers could hold their own. Men like Rosevear, Lambert and Gillete flew for the Royal Flying Corps. Lufberry, Baylies and Putnam saw combat with the French Lafayette Escadrille. Our own air service produced the "Balloon Buster from Arizona" Frank Luke, George Vaughn . . . and the first American flyer to earn the Medal of Honor, Captain Eddie Rickenbacker.

America's leader in the air war



was a dynamic, professional soldier: Brigadier General William Landrum Mitchell . . . "Billy" Mitchell.

After years of brutal trench warfare . . . after Verdun, Flanders and Ypres, Mitchell's tactics of massed air power in support of ground troops shattered the Hindenburg Line in the St. Mihiel and Meuse Argonne sectors. Within weeks of these staggering blows, Germany had signed an armistice ending the first World War.

America soon pulled back behind her oceans and demobilized. The air service was slashed by 95 percent.

America didn't want to listen to stories of her airmen flying to their deaths in flaming coffins, the lack of parachutes and of French guns that could not take British ammunition . . . of Americans fighting in French Nieuports and Spads, in British Sopwith Camels and Pups because America—the inventor of the airplane—had no combat planes of its own.

In addition to the famous battleship tests, Mitchell argued for a strong air arm until his dying day. He warned us of Japanese expansion and of the weakness of our Pacific defenses. He warned of the horror of future air war and begged for support of his airmen. He asked for a new military academy of the air and for a weather service for his pilots. He prophesized aerial torpedoes and airborne infantry. He spoke of inflatable rafts and of variable pitch propellers, of aircraft radios and of four engined bombers. But his strongest plea was for an independent and equal air force, commanded by flyers.

Ignored, he took more direct and more drastic steps. He attacked the Army and Navy staff planners in the press. For this he was court-martialled and forced from the service.

Other men, the Mitchell apostles, stayed and fought for air power within the system. They scouted for forest fires and flew the air mail. Eaker and Spaatz flew the great endurance flight of the Question Mark, while Hap Arnold forced through the all metal bomber and the B-17.

Billy Mitchell died before his prophecies came to pass. He didn't live to see the German Luftwaffe wage blitzkrieg war against Poland and France. He was gone before German paratroopers—airborne infantry—smashed the low countries. If he had lived, he would have cheered the British Royal Air Force protecting the Beach at Dunkirk and breaking the teeth of the German Air Force in the Battle of Britain.

He did not live to see the Japanese wreck the US Fleet at Pearl

Harbor and destroy the Far East Air Force on the ground in less than one hour.

Because of Japanese air power we lost the Pacific Fleet. Without the Fleet and without air power, the Army was lost.

Guam lasted 3 hours and 35 minutes . . . Wake Island two weeks. Hong Kong was lost on Christmas Day and Singapore surrendered in February. Java held out for only one week after the British Asiatic Fleet was destroyed by Japanese air power. Bataan fell in April and Corregidor finally hauled down the Stars and Stripes in May.

Japan had won the war she had set out to fight. We had lost the battle to that point . . . but the war we intended to fight was far from over.

Out of Australian bases the remnants of American air power, Kinney's kids, the forerunners of the 5th and 7th Air Forces, waged savage war in the Southwest Pacific holding the enemy at bay as America girded for war.

In the skies over Europe, the war was fought first by the heavies, the B-17s and the B-24s flying unescorted missions because America—the inventor of the airplane—had no long range fighters. Our air doctrine called for high altitude, daylight precision bombing of industrial Germany as the only way of defeating the German armed forces. The targets were vitally important to both the allies and the enemy . . . we had to take our losses . . . we had to hit the targets . . . and the Germans defended them accordingly.

In the worst air battles of history, the 8th and the 15th Air Forces staged raids over Europe. In freezing temperatures, on an oxygen bottle lifeline, thousands of flak fragments tearing the skins of both plane and man, enemy fighters coming in from all around the clock . . . control surfaces shot away . . . dead pilot at the controls of a plane screaming and spinning as it fell in protest to the earth and a 5 mile high jump to capture or death.

Schwienfurt . . . Regensburg . . . Ploesti . . . Hamburg . . . Stuttgart and Berlin all took their bloody toll. But there was no halting the bombing plan. New fighters—the Jug and the Mustang. Zempke and his Wolfpack, Davis and his Black Cats from Tuskeegee would sweep the skies of German planes . . . and without her Air Force, Germany was doomed. The retreat had become a rout. In her death throes, Germany produced the only operational jet fighters of the war, the V-1 and V-2 Rockets,

Nieuport 28s returning to base.

Dawn patrol—France 1918





The Canvas Hangar Base France 1917.

THE SPAD
This French designed aircraft was the favorit of American pilots. With twin Vickers machin guns it proved to be a deadly fighting machine





Brig Gen William (Billy) Mitchell

WORLD WAR I
Late to battle, the fledgling pilots flew the more sophisticated French and English aircraft against seasoned German pilots. Under Brig Gen Billy Mitchell's keen direction, the American acquitted themselves well. US air power was born.



The Handley—Page Bomber—the eye of the future.



THE FOKKER Dr I TRI-PLANE
The much dreaded symbol of Baron Von Richtoffen's Flying Circus was this small and highly maneuverable aircraft.

the 4 engined "New York Bomber," Tiger Tanks that spearheaded the Battle of the Bulge and were only months away from their own atomic bomb. The only weapon the Allies had that could meet these threats was air power. That weapon was used and German resistance was crushed.

At the same time, in the Pacific, first Doolittle's Tokyo Raiders then the Coral Sea, Midway and the Bismarck Sea proved to the enemy that we still had teeth.

Joint air, sea and ground operations against fierce opposition seized the Solomons, the Gilberts, the Carolines, the Marshalls and the Marianas. From each island group, strikes were launched against the next until the stepping stones had reached Japan. Transports flying the "Hump" brought men and supplies into China where Chennault's Flying Tigers of the 14th Air Force slashed at the Japanese without mercy. A ring of steel was forged around Japan by Allied air power and sea power but the invasion was yet to come. An invasion that would cost at least one million American casualties and possibly four million Japanese. Instead, the President ordered two B-29's the "Enola Gay" and "Boch's Car" to attack with atomic weapons. So ended World War II.

With victorious peace restored, America went back to the business of life. The armies went home and swords were beaten back into plowshares. But this time there was a difference. Most of Mitchell's prophecies had come to pass, and the nuclear age had begun. General of the Air Force Hap Arnold restated Mitchell's warning to America:

"There will come a time when there will no longer be any spot on earth and certainly not in America that is safe from attack by air. For our protection, we must have an Air Force second to none.

"For this, we need a great aviation industry, a great air transport system and a great body of trained personnel. But we'll need more than planes and pilots and mechanics . . . we'll need scientists and mathematicians and we'll need the full inventive genius of the American people.

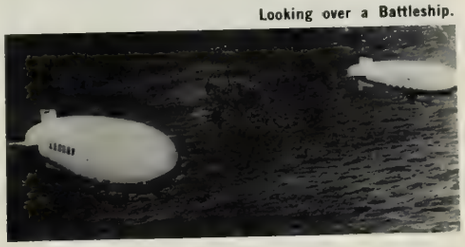
"With these we can protect the future—ourselves and our allies—with the weapons of the future."

On September 18, 1947, the oath of office was administered to the first Secretary of the Air Force, W. Stuart Symington and to the first Chief of Staff, General Carl "Tooey"

Martin MB-2s—they sank the Ostfriesland.



Looking over a Battleship.



THE 1920s
During the lean years of world disarmament following WWI only the most dedicated endured. It was a period of stunts and publicity, doing the most with the least, accidents and frustrations. In a struggle for mere survival, they perservered and made constant progress against all odds.



Parachutists on Curtiss JN-4.



First Round The World flight 1924.



The spirited mechanics of Biggs Field, Texas.

LUCKY LINDBERG
No other single event ever had such far reaching impact upon aviation as did the Lindberg flight. It was the turning point that showed a shrinking world. Public awareness of the potential of air power zoomed. From this day on, there was a shift towards military appropriations for the Army Air Corps.



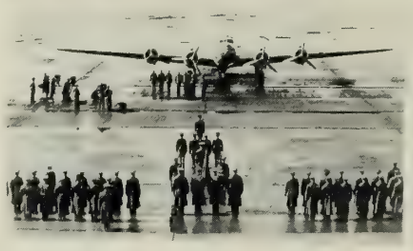


Martin B-10s.

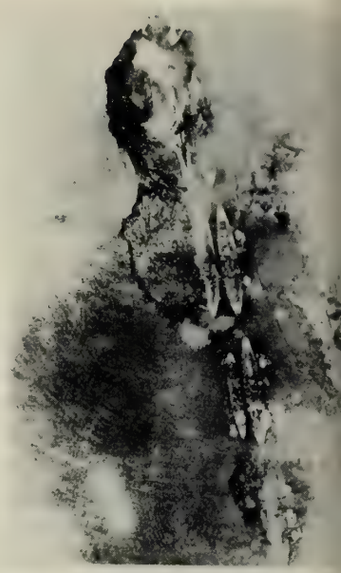
THE 1930s
During the thirties the US aircraft industry began its climb towards a position of world leadership. As clouds of war loomed on the horizon, designs by the score emerged from the drawing boards—each better than its predecessor.



The B-19.



The first YB-17 at Langley Field.



Over battleship row.

PEARL HARBOR
The disaster of Pearl Harbor brought w
it the vivid lesson of the effects of
power. The shots shown here were ta
by a Japanese bomber pilot during
attacks.



The Flying Tigers' Curtiss P-40s.



Japanese Zero on aircraft carrier.

Spaatz. The 40 year ties to the Army were cut and a new era began in which air power was firmly established as the nation's first line of defense and its chief hope for peace. Mitchell's greatest dream had come true.

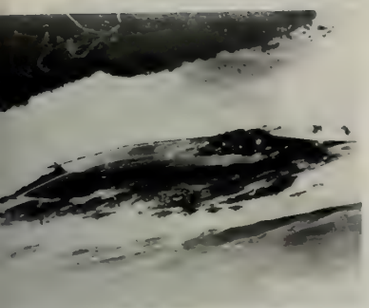
The young Air Force would be challenged before it was one year old. On June 22, 1948, the Russians blockaded Berlin in an attempt to force the allied powers from that city. If the Allies stayed, the city would starve. If the Allies withdrew, then Western Berlin would fall behind the Iron Curtain. The city was not abandoned. Berlin was saved by allied airlift. Pilots of the Air Transport Command flew a staggering 248,000 sorties into Templehof Field. Planes flew three minutes apart, around the clock, for nearly a year, averaging 7,000 tons of supplies daily until the blockade was lifted. Air power had saved Berlin and had given the Russians a stinging propaganda defeat.

By June 1950 a new and deadly challenge was hurled. The Republic of Korea was invaded from the North. When the United Nations took action to aid South Korea, our Air Force was its most powerful argument. Far East Air Force planes cut North Korean lines of communications, bombed forward positions and reduced the enemy's industrial base. Air power held the Pusan Perimeter and blasted the way open for the invasion of Inchon. But it was in the frozen skies over the Yalu River that the Air Force wrote a new and glorious page into its history, in a place called "MIG Alley."

From the beginning, the Air Force owned the skies of Korea, the only challenge came in the area just south of the Chinese border, in MIG Alley, where Chinese and Korean pilots engaged the American Sabre jets. The reds had every conceivable advantage. Their MIG-15 was faster, more maneuverable and could turn inside the Sabre. It could fly 5,000 feet higher than the Sabre. Red pilots flew across the Yalu to do battle when they wanted to and could streak for sanctuary when they were beaten. They fought over their own terrain without fear of capture, if forced down. No concern for anti-aircraft and no need for escape and evasion plans. With every advantage in their hands, we still got them 14 to 1!

It was American air power that neutralized Chinese superiority in manpower. It was finally the threat of American air power that brought them to negotiate a settlement of Panmunjom, ending the Korean action.

Even at the height of the Korean War, the Air Force had somehow found time to airlift 4,000 stranded Moslem pilgrims to their holy city of Mecca and to bring relief to the flood ravaged Netherlands.



tleship row seen from Japanese bomber.

RLD WAR II
the first time in the history of warfare the atre of battle was everywhere. Only through ninance in the air could a war be won. Air ver had come of age.

eeler Field.





B-25 attack on Rabaul.



B-17s over Germany.



The "Jug"—P-47.

P-51 Mustang in England, 1944.





F-86's taking off for MIG Alley.

Introducing Choppers.

KOREA
In the great police action, the US Air Force acted for the first time as a separate military force. Again it tipped the scales in US favor.

VIETNAM
Restricted by political considerations, the USAF role was still the cutting edge.





The mighty B-52 strikes a Viet Cong stronghold.

Another of Mitchell's prophecies was coming true. The Air Force was more than a spear. It was also a shield. When the cold war heated up, America's powerful Strategic Air Command kept the peace by warning any aggressor that if he attacked the free world, he would have no home to go back to. Air Force communications across the frozen Arctic kept watch over North America and air defense fighters sat on alert, day and night, guarding a nation at peace.

More than a weapon of war, Air Force transports used air drop experience to feed cattle stranded by blizzards; hurricane hunters of Air Weather Service warned of impending disasters. And Air Rescue Service risked their lives daily, "That others may live."

In 1956, the Air Force was airlifting UN forces to Suez to enforce a cease fire there. In that same year, Operation Safe Haven saw 13,000 Hungarian refugees airlifted to safety.

In 1962, with the tension of the Cuban missile crisis threatening the world, Air Force planes were diverted to fly UN troops into the Congo and in 1964 went back to rescue the survivors of the Stanleyville Massacre.

The Vietnam war saw a new page added to the story.

The story of Major Bernie Fisher in the Ashau Valley; the Bird Dogs and the Sandies; Khe Sanh and An Loc; Thud Ridge and the Jolly Green Giant; the Gunfighters of Da Nang and Mu Gia pass and that tired old Gooney Bird that came back to fight as "Puff the Magic Dragon"; the Hanoi Hilton; the Son Tay Raid and hundreds of men still missing in action.

New pages are being written: "Nicklegrass," the airlift that saved Israel, and the SR-71 racing the sun across the Atlantic. New pages will be written as your Air Force meets new challenges with pride in the past and faith in the future.

The weapon is here. The tip of the spear and the shield of national defense. The weapon forged in blood, in sweat and in tears. With honor and with courage, the Air Force keeps faith with its motto: Aerospace power for peace, but telling the world boldly "Any time—any place—the mission of the United States Air Force is to fly and fight" . . . and don't you ever forget it! ! ! ! ! ★

ABOUT THE AUTHOR

MSgt Sylva, NCOIC of the Norton AFB Information Office was formerly an instructor in the NCO Leadership School systems of both MAC and TAC. Combining his duties with his strong interests in history, Sgt Sylva developed an Air Force History course unique in its presentation. Rather than point only to successes, the 26 year Air Force veteran addresses the problems and failures—not as a prophet of doom, rather to glorify the victories in light of the hardships that had to be overcome.



ESCAPE

LT COL CHARLES L. POCOCK, JR.
Directorate of Aerospace Safety

Escape denotes personal action on the part of the escapee. Obviously this is different from rescue which is assistance from someone else. If you are involved in an aircraft accident, your chances of escaping are much, much greater than being rescued. There are certain things you can do to enhance your chances of successful escape. Basically, they are the same for all aircraft, but since I'm not familiar with your aircraft and you may not be familiar with mine, let's apply some of the rules to commercial aircraft which we are all familiar with as passengers.

Assuming we can't avoid the trip and we have selected a route to avoid bad weather and congested airports, the next step applies to what we wear. Considering the ever present problem of fire in airplane accidents, cotton provides the best commercially available, aesthetically pleasing fire protection. Avoid such things as polyester, nylon or rayon shirts, socks, and under garments. Until such things as PBI and NOMEX are used commercially, pants and jackets with a high cotton content are best. The next step applies to the seat selection process. Window seats should be avoided because of the possibility of a window blowout. The center seat is better but the aisle seat is best because it also allows faster egress during ground emergencies. An aisle seat on an emergency exit row is better yet.

After boarding, start to formulate your escape plan. As you enter, get a good look at the door opening mechanism and type slide deployment system. After finding your seat, look around for the nearest exit. Remember that in the event of an emergency most people will

try to get out the same door they came in. This is seldom the best choice. Additionally, many successful escapes have been made by going over the tops of the seats rather than using the aisles and going against traffic.

Take out the emergency instruction card and check the location of the emergency exits and again check your relative position. Look at the instructions for opening the exits and the direction they open—in or out—upward or sideward. Check what kind of slides are installed and how they are deployed. Now imagine the lights are out and its dark or the cabin is filled with smoke. Do you think you can make it out?

Read the description of emergency oxygen equipment. Most commercial aircraft have four masks for each 3 seat sets. There are two reasons for this: First is the possibility of babe-in-arms cases where there are four people in three seats. Most importantly, though, is the possibility that the masks won't deploy as advertised. Remember, in the event of a rapid decompression there is an extra mask for the seat sets ahead and behind you.

In the center seats of the wide body aircraft the oxygen masks have to fall a long way. Yawing or deceleration of the aircraft may cause the masks to swing out of your seated reach. Be aware of this, too. Some aircraft have the masks in the back of the seat in front of you. Also, some aircraft have a manual capability to release the masks. Remember the configuration is not standard for all aircraft of the same type or are all aircraft belonging to one airline standard. Read the card each time.

Now, we have done about all the preplanning, so we can sit back and enjoy the trip. Keep your seat belt fastened though; several people are seriously injured each year in unexpected turbulence encounters.

Assuming that all didn't go well and either an aborted takeoff, overshoot, short landing or crash landing ensues, there are some positive things you can do to enhance your escape. First, it is absolutely essential to protect your arms and hands, legs and feet, and your head. Without full use of your means of locomotion, escape chances are significantly reduced. Obviously, your seat belt should be as tight as you can get it. Some emergency instruction cards show the feet straight down in a normal seated position while others show the feet extended under the seat in front. Both are bad. In the first case rapid deceleration forces can cause your feet and legs to go forward and upward. When this happens, shin bones get broken on the seat back in front of you, and if the seat collapses (which is a good thing for absorbing energy) your feet get pinned under the seat. The same reasoning applies to extending your legs. The best place for your feet is on your briefcase or on the lower horizontal bar across the back of the seat in front of you. This puts your knees up in a fetal position.

Your head should be down between your knees, lower than your shoulders if possible so that it doesn't get hit by any forward "flying objects." If possible, your arms should be folded across your stomach and held by your thighs. This prevents flailing. Next best would be around your legs in a "cannon ball position."

After impact don't be in a big hurry to get out of your position. Airplanes bounce occasionally and there may be several impacts. A good rule would be to slowly count to six after the last impact before getting up.

That's the last slow thing you should do. Speed should be the rule now—get up, get out, and get away in 30 seconds or less. Fire propagation takes time, but not much. Every second counts so make your way to an exit or fuselage break. If you can grab a pillow, blanket, or jacket on your way out to breath through, you may filter out some smoke and you will prevent a sudden gulp of superheated air. If you can think of it, especially at night, keep one eye closed so that a sudden flash of light or smoke won't blind both eyes.

Invariably there is a best egress side of the aircraft. Before you get out make sure you are going out the best side. Feel and look out the window before you open the hatch to make sure you're not opening a furnace door. The exit may be jammed so try the handle in both directions and pull hard before giving up, but don't hesitate too long.

It may sound elementary but make sure you have a good slide before using it. Strong winds or running engines blow slides sideways and under airplanes. Sometimes they don't inflate or get punctured. If the airplane rocks back on its tail the forward slides make a vertical line to the ground far below, and vice versa.

Once on the ground, get away from the aircraft at least a hundred yards, before stopping to look back.

These are a few ideas that have been common in hundreds of successful escapes from military and civil aircraft crashes. If you can do just some of these things your chances of escape are greatly increased. ★

THE IFC APPROACH

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

How many times have you heard the expression, "It's not what you know, but what you don't know that causes accidents?" At least once or twice I'm sure. The expression applies just as well to instrument approach charts as anything else. Not only can "what you don't know" cause accidents, it can ruin your whole day. Since everyone wants to have a safe flight and a smooth landing, we want to offer some food for thought concerning how to interpret the planview on Intrument Approach Procedure charts.

Q. What information is contained within the planview of an instrument approach procedure (IAP) and how is it normally depicted?

A. The planview of the instrument approach usually depicts such information as en route and feeder facilities, terminal routings, approach NAVAIDS, missed approach routing, holding patterns, significant obstacles, communications data, and in some cases topography.

Two basic formats are used to present this information. First, when all procedural and terminal information is to scale, as in Figure 1, the procedure will be printed without dashed concentric rings. The land/water contrast on the Quantico chart makes it easy to tell that everything, even the 363-foot obstacle Northwest of the field, is shown to scale.

The second format, such as the one shown in Figure 2, includes dashed concentric rings when the procedural and terminal route information cannot be depicted to scale. However, in either format, all information contained within the solid inner ring (normally 10 NM for low altitude, 20 NM high altitude, and 5 NM for "copter only") will always be depicted to scale.

When more than one dashed concentric ring is depicted, the inside dashed ring will show the feeder NAVAIDS/fixes used by air traffic control to transition aircraft from the en route structure (High or Low) to the initial approach fix or to the NAVAID (Figure 2). In a few cases (such as the HI-TACAN RWY 15 at Holloman AFB), transition routes to a holding fix are depicted. These feeder NAVAIDS/fixes are positioned so the magnetic bearing relationship is accurate. However, distances may not be to scale. The outer ring will show NAVAIDS, fixes, and intersections which are a part of the appropriate en route structure (high or low).

Normally, the terminal routings to low altitude IAF's will depict magnetic course, distance and minimum altitude. (Figure 3). High altitude Terminal routings, normally only show a course and distance. (Figure 2.) If an altitude is depicted, it should be considered the minimum IFR altitude for that route.

The terminal routings in Figure 3 give the course, distance and minimum altitude to the Compass locator at the outer marker (LOM). Although it is not labeled as such, it is considered an IAF since it is the facility on which the procedure turn is based and is coincident with the final approach fix.

The planview usually shows only those NAVAID facilities which are necessary to fly the approach or the terminal routings. Those facilities identified as feeder facilities will be shown with the name, frequency, and identifier of the navigational aid. En route facilities, unless they are used in a dual capacity (or e.g., transition facility, missed approach facility, etc.) will be identified by name only. (Figures 2 & 3).

FIG. 1

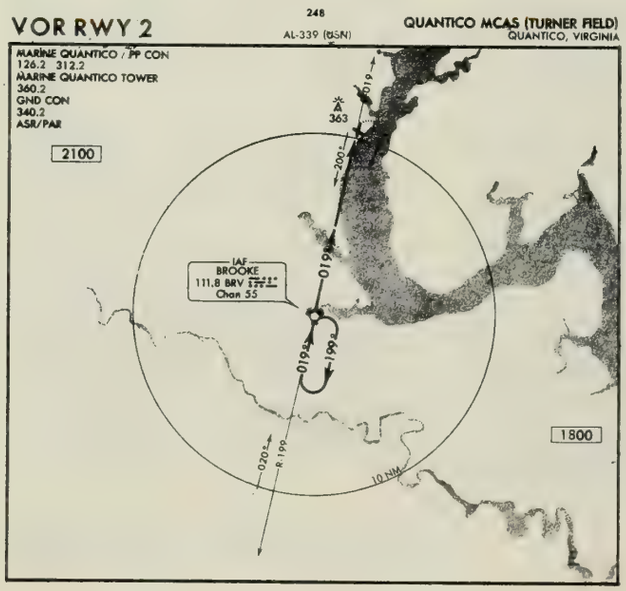
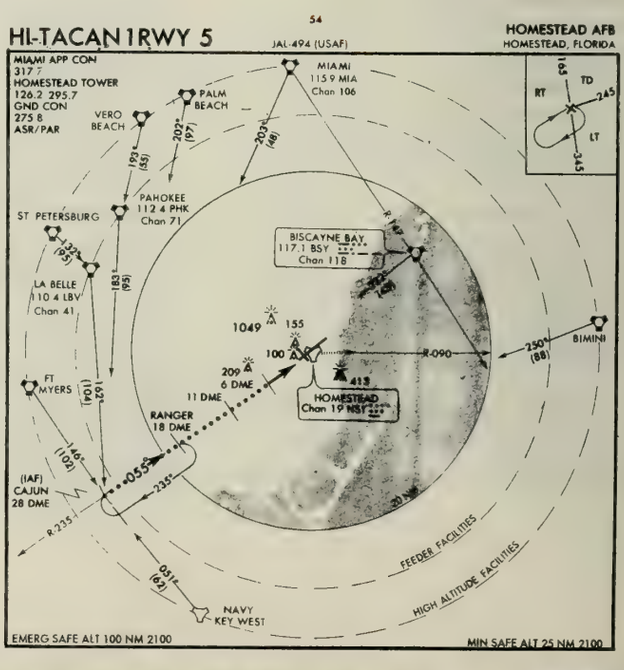


FIG. 2



Communications data, located in the upper left corner of the approach chart, consists of the names and frequencies of the various air traffic control services available to the pilot. These services may include approach control, tower ground control, and Automatic Terminal Information Service (ATIS). A star next to the tower's name indicates that it operates less than full time.

Immediately below the communications data, the availability of approach radar is listed. This is indicated by the applicable letters: ASR, PAR, or ASR/PAR. The appropriate radar minimums may be found under the aerodrome listing in the En route Supplement and in the minima data block on many high altitude approaches. (NOTE: Circling minima listed on high altitude IAP's do not apply to radar approaches.)

Another service sometimes advertised under the communications data is the phrase, RADAR VECTORING. This indicates the availability of radar vectoring service through any portion of the procedure except final approach. When *RADAR* is required for the execution of the procedure, the note "RADAR REQUIRED" will be shown. It is normally located in the lower left corner of the planview.

A careful and complete study of the legend which is located inside the front cover of each approach book will greatly enhance a pilot's ability to interpret the information contained on the planview.

RADIAL/DME DIRECT ROUTES

Q. May all Air Force pilots file routes or route segments from one radial/DME fix to another radial DME fix?

A. No. The only Air Force pilots authorized to define portions of their routing in accordance with degree-distance (Radial/DME) route definition are those engaged in one or more of the following missions: (Reference FAAH 7110.665.)

a. Airborne radar navigation, radar bomb scoring (RBS), and airborne missile programming missions.

b. Celestial Navigation Missions.

c. Target aircraft operating in conjunction with ADC interceptors and ADC interceptors while en route to and from assigned airspace.

d. Missions conducted above Flight Level 450.

e. Aerial Refueling Missions.

This of course, does not preclude you from filing to a radial/DME initial approach fix or from filing RNAV routes (if authorized).

IFR CLEARANCE REQUESTS

Q. What information should be included in a request for an IFR clearance?

A. Air Traffic Control (ATC) needs the mission call sign, action requested, type flight plan, and destination airport on initial contact. EXAMPLE: "Travis Clearance Delivery, Post 11, clearance on request, IFR to Offutt."

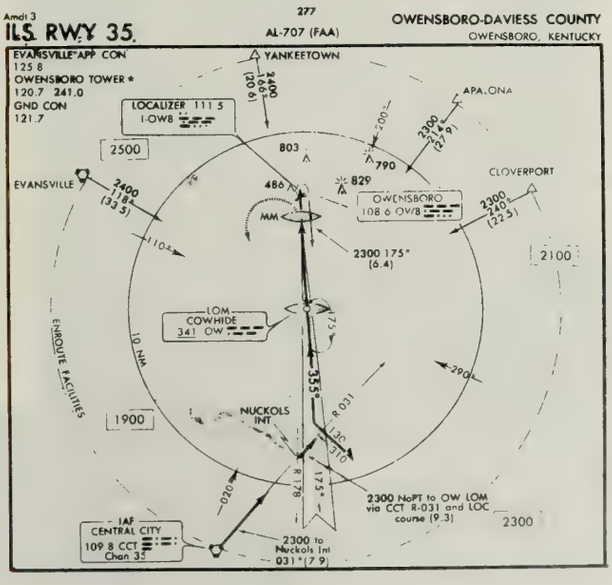
Q. Why do I need to state my destination on initial contact?

A. So ATC can ensure that you are receiving the proper clearance. Believe it or not, the following has happened: The pilot had filed a stopover flight plan from Base A to B to C to B to A. The crew landed at Base B after the first leg, refueled and was ready to depart for Base C. They called for their clearance but did not state "Base C" as the destination. The clearance read, "cleared as filed." Departure was normal until ATC queried "Where the !°*&$¢% are you going? If you hadn't guessed, the "cleared as filed" was for the leg from Base B to A and not the clearance for Base B to C.

If you have filed a stopover flight plan, there are additional ways to ensure that your desired flight plan is available when you are ready for departure. These are: (1) When requesting a Flight Service Station to activate the next leg of your flight plan, always include your proposed destination, and (2) advise ground control, after landing, of your proposed departure time and next destination. These methods should help ensure you have proper clearance when you depart for your destination.

If you have any questions or comments concerning an "IFC Approach" article or have a favorite subject you would like to see addressed in a future article, write or call USAFIFC/FSD, Randolph AFB, TX 78148, AUTOVON 487-4276/4884. ★

FIG. 3



a bird's eye view of hydroplaning

COLONEL WARREN J. HUNT, Directorate of Aerospace Safety

I recently went out of my way to discuss wet/slippery runway operations and the hydroplaning phenomenon with pilots of varied experience levels. These discussions revealed that many pilots are poorly educated on these subjects and are sometimes misled by the flight manual. NASA has conducted exhaustive research in this area and evaluated each of the many elements affecting runway traction. It is appropriate to acknowledge Mr. Walter B. Horne, manager of Special Projects (DLB) of the NASA Langley Research Center, for his superb contribution in this field. I will use a lot of his words of wisdom to define the types of hydroplaning.



Let's quickly discuss *dynamic, viscous* and *reverted rubber* hydroplaning and then get into the meat of this dissertation which involves the importance of a proper touchdown, crosswind effect on runway drainage, hydroplaning speed computations, braking techniques and the use of nose wheel steering.

Dynamic hydroplaning is a condition where the tires are separated from the runway surface by a fluid. Under conditions of total dynamic hydroplaning, the pressures between the tires and the runway lift the tires off the runway surface to the extent that a nonrotating tire, such as you have when landing, will not spin up after touchdown, or a rolling (unbraked) tire will slow in rotation and may actually come to a stop. Under those conditions, the coefficient of friction is reduced to zero, making wheel braking, tire cornering and nose wheel steering totally ineffective.

Viscous hydroplaning occurs only on runways that have a smooth surface texture or a runway surface made smooth by rubber deposits or paint. A tire on these surfaces can only partially displace the trapped water film. Even a light dew can produce viscous hydroplaning on a very smooth runway surface. Recovery of tire braking and cornering while viscous hydroplaning is speed-dependent and may not be achieved until the aircraft decelerates to a very low ground speed of about 40 or even 30 knots.



White streaks (arrows) are hydroplaning marks (right main gear) near Bak 9 pendant.

Reverted rubber hydroplaning occurs *only* if the wheels are locked and a prolonged skid develops. This is the worst of the three because extremely low traction can persist down to zero speed. More importantly, with the wheels locked, the tires lose all cornering capability and directional control is nil unless you get off the brakes and get the tires rotating again. Once they spin up, you will regain cornering capability and can effectively use nose wheel steering and/or aerodynamic controls. You will also want to start feeling out the brakes again to get the beast stopped. Excuse the brevi-

ty, but you've all read hydroplaning articles before and I don't want to belabor the point.

Now, let's go out to the airplane and look at the tires. We can't expect to have new tires for every flight, but you should know that a new tire with full tread depth may require as much as 0.2 - 0.3-inch water depth to hydroplane, while tires with negligible tread require as little as 0.05 inches.

We're on final now with a left crosswind, wet runway, and facing the decision as to where to put this beauty down. Your flight manual tells you to be sure you are on speed, to put her down early, and touchdown firmly, but not many say whether to touchdown left of center, right of center or down the middle. You better believe them when they say to be on speed because if you are not, you probably won't get it on the ground either early or firmly. You may need every foot of the runway and any portion you leave behind because of excess speed is gone forever.

Heed the "firmly" advice, too, because that's the best way to break through the fluid and knock-off 10-15 knots extra. We all pride ourselves on "grease jobs" but it's best to swallow your pride in this situation.

If your flight manual says to land on the left, right or middle—do so—but if it says nothing, I would land on the crown. Why? Because obviously I don't want to land on the right because that's where the wind is pushing me and I may need that part of the runway to get out of a drift or skid. Why not the left side? Because the left crosswind is reducing the water drainage from the upwind side, which enhances water pooling, especially if the runway has a transverse slope of one percent or less. NASA research has proven this conclusively.

Now, at what speed would you expect to encounter dynamic hydroplaning? Some of the flight manuals tell you and others don't. Those that tell you may be misleading so read it carefully. Example: The T-39 book says you can expect total hydroplaning at approximately 78 knots for the nose tires and 121-124 knots for the main gear tires. The old formula of $9\sqrt{P}$ was used with nose tire pressures of 80 ± 5 and main tire pressures of 185 ± 5. These figures are correct, BUT only for tires that have already achieved spin-up speed. You fighter types look at your wingman's tires and you big guys look at your own during your next approach. Your tires will be stopped dead.

NASA research has proven the dynamic hydroplaning speed formula for nonrotating tires is $7.7\sqrt{P}$. It makes a big difference because the T-39 speeds would now read 67-71 knots for the nose tires and 103-106 for the mains. That's 18 knots lower for the mains. If your touchdown was computed as 115, you would feel secure using the flight manual info, but you are actually in the heart of the hydroplaning speed range. AFLC has been asked to look into this matter.

You're dynamic hydroplaning now and maybe your flight manual says don't pump the brakes, just apply an ever-increasing amount of pressure. Again, if it says that—do it. We've asked AFSC and AFLC to look at



Reverted rubber patch partially eroded due to scuffing which occurred as tire traveled with yaw angle.



Right main tire with reverted rubber skid mark.

all flight manuals and, if they're wrong, they will be changed. All I can say is, if you get on the brakes, lock them and get below dynamic hydroplaning speed (if you ever do), you will go right into the reverted rubber hydroplaning and stay there till hell freezes over. And remember, you will have zilch cornering capability, so your nose wheel steering won't be of any help except to maybe put you into a skid. That brings us to a new subject.

If you are in a skid, your nose wheels will be castered and aligned with the direction of travel. What now? The flight manual writers seldom stick their neck out here because of the many variables such as degree of yaw, crosswind, cause of the skid, and how much runway is remaining in your direction of travel. I'll give you my opinions which I hope will feed your bar talk and help you reach your own conclusions, but don't shoot me if you follow my advice and get into trouble. I'll be vague so you can't pin me down.

Let's say you're in a slight skid with the nose wheel(s) castered in the direction of travel. I would use aerodynamic controls in an attempt to more nearly align the aircraft with the direction of travel, if I had enough hard surface in that direction, and then engage nose wheel steering. If you are in an aircraft which requires the centering of the rudder pedals to pick up nose wheel steering and the steering is engaged, the nose wheel(s) will rapidly align with the nose of the aircraft. This means they will also be skidding. This probably won't present any problems if your yaw angle is small and you realign the nose wheel(s) with the direction of travel with steering, but if the skidding yaw angle is significant (whatever that means), then you could aggravate the situation. It all depends on the many variables but basically, it's like a car.

Use what you have available to align the vehicle with the direction of travel, keep the tires rolling so you can achieve cornering capability, use steering to put the cornering capability to use and test the brakes. Once braking becomes effective, you should be home free unless you lock them up again. ★



food

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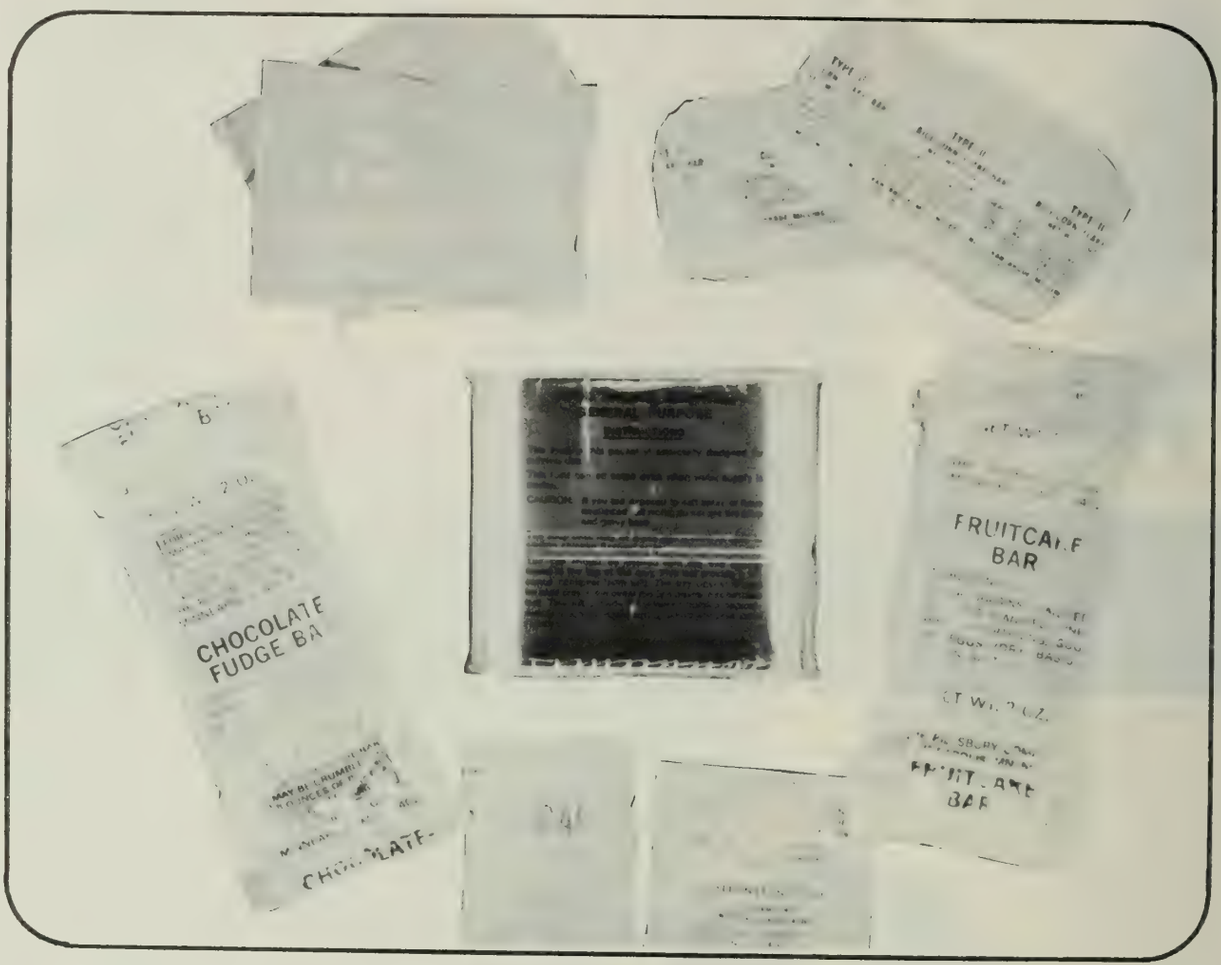


PART I (of a three-part series)

NUTRITION AND SURVIVAL RATIONS

Ten thousand years ago, man was a hunter and gatherer of food. Though food proved difficult to procure at times, he did persist. In time he learned how to acquire more than he could consume; hence a surplus. This surplus allowed man to devote more time and energy toward making life easier and more enjoyable. But man also lost some of his individualized skills and techniques of food procurement. This loss made him both dependent and specialized—dependent on others for his needs and wants, and specialized in his job.

How would you, the aircrew member, fit into an environment where you had to think in terms of "Where will my next meal come from?" For some, adapting to the environment and finding food would be easy, but for others, disastrous. The military realizes that today not everyone is able to live out of doors and off the land without some aid from his technology. So, through survival education man is learning to adapt to his environment.



Good physical condition is important to all military personnel and especially to you, the aircrew member. Many aircrew members have had emergencies, found themselves on the ground, and then, due to poor physical condition, found the going rough. Survivors and prisoners of war (PWs) who maintained good physical condition increased their effectiveness in coping with the environment, deprivations, and enemy personnel.

To maintain good physical condition it is important to eat nutritional foods. It is necessary to know the components of food and how the body utilizes these components, to fully understand the value and importance of food. There are two groups of basic food components: major food solids (fats, carbohydrates, and proteins) and minor constituents (minerals, salts, and vitamins). Most foods contain a mixture of these components. The ingestion of these components, in varying degrees, is important for adequate nutrition; some can be stored by the body for later use, but others must be consumed regularly.

This three-part article on food will cover Nutrition and Survival Rations (Part I), Subsistence from the Land (Part II), and Food Prepation (Part III). Parts II and III will be published in subsequent issues of *Aerospace Safety* and will explain how to overcome many different difficulties encountered in survival situations.

The following is a breakdown of the food components and their application to a survival situation:

FATS

Body Uses: Fats are used to generate body heat or to supply energy. Ingested fats can also be converted to body fat which can be utilized later. Fat is an important source of energy because it will yield twice as much energy, by weight, as carbohydrates.

Sources: Solid fats are found on meats in the form of lard, drippings and suet. Milk fat is contained in dairy products.

Survival Uses: A constant intake of solid fats is not necessary to maintain good physical condition except where a special diet is necessary. For example, in arctic areas a large amount of fat is required to generate heat. Fats also give a longer feeling of satisfaction of fullness due to the delay in their passing from the stomach. In PW or

survival situations a deficiency or a complete lack of fat could lead to kidney lesions or other diseases. Do not eat mineral oils, such as liquid parafin, or greases, such as vaseline, for they have no food value.

CARBOHYDRATES

Body Uses: Carbohydrates are used as quick energy for muscle movement. Carbohydrates may also be converted into body fat for later use. They supply the body with two-thirds of its immediate energy.

Sources: Cereal grain, potatoes and other tubers, animal blood and livers, candy, etc.

Survival Uses: Carbohydrate sources such as tubers should be cooked to facilitate the body's use of nutrients. During difficult walks or other strenuous physical activity, candy provides an excellent source of energy. The sugar found in survival rations will also serve the same purpose. In starvation situations the presence of carbohydrates in the diet will help prevent the body from depleting its own body fat and protein (muscle).

PROTEINS

Body Uses: Proteins are the building blocks of the body. They are needed for the growth, repair, and maintenance of body tissue.

Source: Protein is found in the lean meat of animals and in other foods such as milk, cheese, and eggs. Protein is also found in all plant foods and especially in seeds like those of grains, beans, peas, and nuts.

Survival Uses: Protein has the distinct advantage of being available from plant and animal life. To a limited degree it can be converted to dextrose for energy. If given a choice, animal life will provide more protein than plants. In PW or survival situations the lack of protein can cause a deterioration of physical and mental capabilities.

VITAMINS

Body Uses: Vitamins are substances necessary for the regulation of body processes. They serve as a catalyst for metabolic reactions within the body. The chemical factories in our bodies are not capable of manufacturing these substances, so we must replenish our stores regularly.

Sources: Plants and animals.

Survival Uses: A vitamin deficiency could cause anything from beriberi to just ill health, depending on the specific vitamin lacking. A diet balanced between plant and animal foods will enable most vitamins to be absorbed and utilized by the body.

NOTE: Solar radiation serves as a catalyst which enables the skin to produce small amounts of Vitamin D.

MINERALS

Body Uses: Minerals are used in the building of bones and teeth, the formation of organic compounds and body fluids, and influence the function of body tissue. Minerals are essential in maintaining the electrolyte balance of the body. Without an intake of minerals you could experience loss of electrodes in the body which in turn can cause sickness. For example, the lack of salt causes muscle cramps during heavy perspiration. An excess of minerals, especially salt, can also cause problems. Salt taken without an adequate source of water causes thirst, dehydration, stomach ulcerations, and eventually salt poisoning. Salt poisoning is the body's inability to expel excessive amounts of salt either through urine or perspiration because of the lack of water.

Sources: Minerals are essential in maintaining the body and are found in most foods, both natural and processed.

Survival Uses: Though some minerals are consumed by drinking water, a balanced diet is needed to assure an adequate intake of essential minerals.

With this information on the food components, let's look at the general purpose rations adopted by the military.

GENERAL PURPOSE SURVIVAL RATIONS

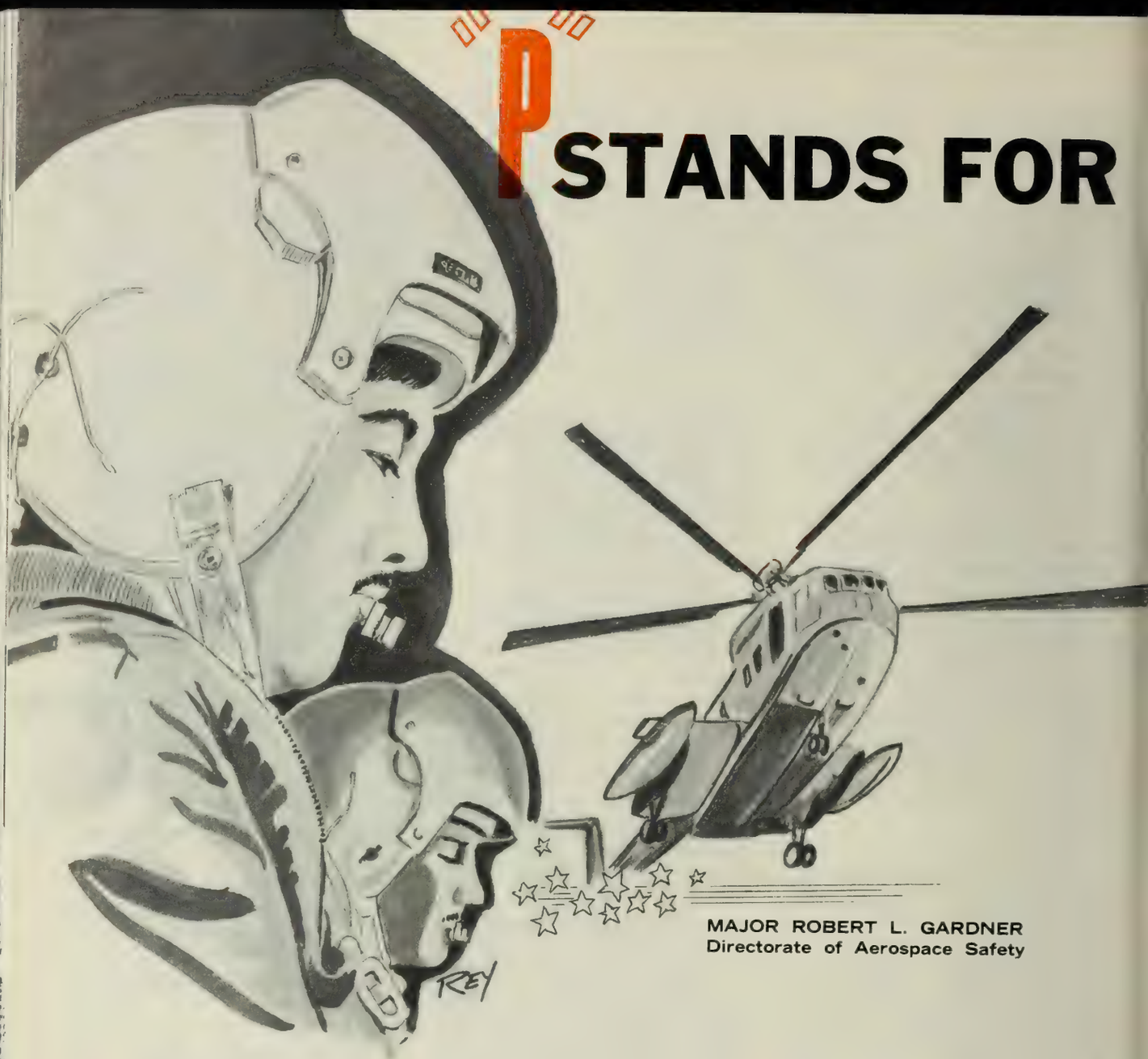
The general purpose survival ration in your survival kit was developed over a long period of time and is suitable for use in any survival situation, under all environmental conditions, including those where potable water is limited. Four food bars of uniform nutritional content comprise the major constituents of each food packet. Six different bars have been developed for random assembly into the packet. The protein content of these bars is rigidly controlled so that the food packet conserves body water yet assures maximum value from protein at any level of consumption. This unique nutritional design allows the adjustment of issue and consumption to anticipated needs. It was adopted by all branches of the Armed Forces as a standard survival ration and is also used in training and indoctrination at the Air Force Survival Training Schools.

The food packet is packaged in a 12-ounce rectanglar can (key opening type) and consists of the following:

Food bars, survival type (four of six types randomly selected):
- Fruitcake, Chocolate fudge,
- Cornflakes, Rice-Cornflakes,
- Cornmeal bar, Cheese potato
- Coffee—instant
- Sugar
- Soup—gravy base, chicken flavored
- Can opener—key type (taped to container)
- Directions
- Total Calories: 870

It's important to remember that it's not how much you eat but rather what you eat. You should not restrict your diet to just one particular food source, but should try to eat a variety of foods to assure an edequate diet. It is possible to starve to death in an abundance, only because of what you're *not* eating. (Next month—*Subsistence From the Land.*) ★

"P" STANDS FOR



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It was a sunny 73 degree afternoon when Captain Roger Rollon and Captain Henry Hover pulled in collective and brought their H-3 into the calm coastal air. Both Rog and Hank were experienced helicopter instructor pilots. Their mission today was a training sortie and each pilot was going to practice autorotations. The only thing unusual was that neither pilot had practiced simulated engine out landings for over two years and they were scheduled to requalify themselves. This had caused the crew to prepare extensively for the flight.

The day before, both pilots reviewed the flight manual procedures concerning autorotations and during the pre-mission briefing autorotations were again covered in detail. As a matter of fact the crew briefed autorotation training twice that day. Earlier in the afternoon the two pilots had flown the same helicopter and when the autorotation rpm was checked it was found to be low, so they had terminated the flight and turned the chopper over to maintenance for adjustment.

This time the autorotation rpm was right on. As a precaution the crew conducted a fly-by over the runway at 150 feet so they could regain the proper site picture for starting the flare. Roger flew the first two autorotations to the runway and then due to other traffic, tower moved them to the helicopter transition area, which was a closed taxiway.

After five more practice auto's, Rog felt pretty comfortable performing the maneuver which he had not done for so long. He then began alternating approaches

PRACTICE not PRANG



with Henry. On the (lucky?) thirteenth approach and Roger's tenth time at the controls, he positioned the chopper for a straight ahead autorotation. The before landing checklist procedures were accomplished and the instruments looked good.

Entry was started at 1000 feet and the trusty copilot, Captain Hover, retarded the speed selectors to 98 percent as Roger called out "collective is bottomed." The descent was normal with rotor rpm at 104-105 percent and the airspeed 70 KIAS. Captain Rollon started a gradual flare at approximately 150 feet. Although airspeed at this point was not observed, the flare height and wind appeared to be the same as on previous approaches.

As the forward speed slowed, the rate of descent did not decrease normally and the helicopter rapidly fell through the last part of the flare. Roger recognized he was too low, called for speed selectors and initiated a recovery as the speed levers were advanced.

But—it was too late. Before the big chopper could be rolled level it struck the ground in an approximately 15-18 degree nose high attitude with 15 knots forward speed. The main landing gear did not touch down and the lumbering machine momentarily stabilized in a 10-foot hover still moving slightly forward. The chopper then began to yaw right so Roger immediately landed the helicopter and shut it down.

Although the crew heard a clunk they did not realize they had hit the runway. The tail rotor blades had struck the ground first, followed by the tail cone. All five tail rotor blades had to be replaced, the intermediate gear box cowling was damaged beyond repair and the gear box was cracked. Shrapnel from the blades tore a 3-inch hole in the left sponson and dented fairing above the cargo door. In addition, the tail rotor gear box and rotor head were replaced and sent to depot for inspection.

Why did this mishap occur? The crew was experienced, the air-

"P" *continued*



craft was airworthy, altitude near sea level, wind calm, and weight was not a factor. Most likely the pilot allowed the airspeed to get too low during the flare entry and this resulted in the higher than expected rate of descent in the bottom of the flare. Then the pilot failed to rotate the chopper level or initiate recovery soon enough to prevent the tail rotor from striking the ground. The crew's lack of proficiency in the maneuver and the command's procedure of letting pilots requalify themselves in autorotations were also contributing factors.

A few months later, at another location involving a different type of twin engine helicopter, a similar mishap occurred. This time, Captain Sammy Smooth Slide, instructor pilot, and Major Audi Rotate, instructor pilot upgrade student, were at the controls of a UH-1N. Major Stan Evaluator, Wing Flight Examiner, was also on board to administer a no-notice flight check to Captain Slide.

After accomplishing several basic transition maneuvers, Major Rotate completed six autorotations. Captain Slide then assumed control to practice a 180-degree autorotation. He rotated the throttles to flight idle, entering the autorotation at 500 feet AGL, 90 KIAS, and 95 percent rotor rpm. Captain Slide rolled into a 50-degree right bank and approximately halfway around the turn the airspeed had decreased to 60 KIAS. Sammy lowered the nose of the twin Huey to regain airspeed. About the same time, he decided to go around and rotated the throttles to full open at approximately 150 feet.

As Captain Slide continued the turn to line up with the runway, he decreased bank and dive angle and applied some up collective; however, the chopper continued to descend. At about 25 feet he flared the helicopter to a slight nose high condition. When ground impact was imminent he leveled the bird, but did not bring in additional collective.

The right skid contacted the ground first, then the left skid hit hard and bent allowing the left chin window to strike the ground and break. The chopper bounced back into the air then touched down on the left skid and this impact sheared the cargo hook. As the right skid touched down the aircraft slid another 40 yards with no further fuselage-to-ground contact.

During the last 15 yards of the final slide the chopper turned 30 degrees to the left. When the aircraft came to a stop the crew applied the rotor brake and exited without incident. The hard landing spread the crossover tubes to nearly full extension, wrinkled the tail boom and damaged the underside of the fuselage.

Again in this case, experienced pilots were at the controls. The instructor pilot was current in autorotations and there were no problems with the aircraft. The 5335 foot pressure altitude, 13 knot wind, and 180 degree turn during the maneuver are factors to be considered, but the pilot just didn't take adequate action during the latter portion of the maneuver to stop the rate of descent.

Not only are these two mishaps similar in that they involved practice autorotations, but in both instances, instructor pilots were at the controls. Although autorotations are not considered exceedingly high risk maneuvers, they can be affected by a number of factors and require skill and judgment to be completed successfully. The measure of success is judged by how the maneuver terminates. The pilot must carefully time the exchange of potential, kinetic, and rotational kinetic energies, to achieve a controlled, level-attitude touchdown at a minimum rate of descent and forward speed.

Timing is crucial during the entry, the steady descent, initiation of the flare, level out, and collective application. But, when it comes to *practice* autorotations the most important timing decision is when you initiate recovery or go-around. It doesn't matter whether you are a copilot, brand new aircraft commander or crusty old flight examiner, delaying this decision may give you the same results experienced by Roger Rollon and Sammy Smooth Slide. Remember when practicing autorotations, "P" stands for perfect not prang. If the airspeed is not right or the rate of descent is high, don't take a chance and try to salvage the approach. Even if you are an IP and consider yourself sierra hotel at autorotations, take it around and save not only yourself, but your boss and the Air Force the embarrassment and cost of an aircraft accident. ★

OPS TOPICS

HE ALMOST GOT IT RIGHT

The KC-135 copilot was making a touch and go landing out of a PAR approach. At DH he went visual for landing. The aircraft was aligned with the runway but the heading was 5 degrees right. The IP in the left seat instructed the copilot to use left rudder to correct the heading. While doing so the copilot allowed the left wing to drop. The aircraft touched down firmly and bounced into the air about 5 feet. The copilot had put in a correction to raise the wing but thought the aircraft was on the ground so he applied left aileron and nose down elevator while slightly airborne. This caused nrs 1 and 2 engine cowlings to strike the runway. At this point the IP took control, made a go-around, and subsequently an uneventful full stop landing.

LACK OF RESTRAINT

The C-141 cargo included a large forklift. Approximately 3 seconds after takeoff power was applied, one of the 25,000 pound restraint rail tiedown fittings came out of its receptacle. This let the forklift slip aft and swing to the right against the catwalk. Two 10,000 pound tiedowns failed when the forklift shifted. The remaining tiedowns held and the takeoff was aborted. The 25,000 pound tiedown had not been properly locked in its receptacle.

WIN A FEW

During a survival training demonstration using an MK 13 Mod O Marine Distress Signal, an attempt to function the night end of the signal resulted in an explosion in the user's hand. The malfunction sounded like the report of a 12 gauge shotgun and both ends activated. This is one time that safety preparation paid off. There was no injury. The user was wearing heavy work gloves with liners and was following the safety procedures outlined for the demonstration phase of the training. He sure would have had a hot hand without any protection.

RANGE TRAFFIC

An F-4 was on final for a 30 degree dive bomb pass when the range officer called out traffic. Since it was night and the exact position of the traffic could not be determined, the F-4 pilot aborted the bomb run. Just prior to bottoming out on the pull off, the pilot in the front cockpit saw a light aircraft ahead and to the left. During the range missions that night, the range officer saw four light aircraft in the vicinity of the range. None of the aircraft were working with center.

UTILITY FAILURE

The FB-111 experienced utility hydraulic failure during gear extension. After completing the proper Dash One procedures, the crew got the gear down and landed. The right main tire began hydroplaning on touchdown and blew out when the aircraft reached the porous friction portion of the runway. The difference in braking coefficient was sufficient to cause the tire to fail after it was weakened by reverted rubber hydroplaning.

OPS TOPICS

NO OFF FLAG

The F-15 start, taxi and runup were normal. However, the airspeed indicator did not increase on takeoff roll so the pilot aborted. During the abort, the airspeed indicator began working. At no time was there an airspeed/mach indicator off flag displayed. Extensive troubleshooting has not uncovered a cause. However, this event points up the fact that a good cross check of all the instruments can save problems later. Not all malfunctions trigger the OFF flags.

EARLY CUT OFF

The F-100 pilot made an excellent landing, then with about 4000 feet remaining, he retarded the throttle to idle, turned off the antiskid and unfastened his life support equipment. The engine flamed out with about 3000 feet remaining. There was no discernible malfunction which would cause a flameout. The pilot's actions were not in compliance with the checklist since he accomplished the after landing checks and unstrapped while still on the runway. It is possible that while preoccupied with the other tasks, the pilot inadvertently bumped the throttle and moved it into cut off position.

IT WILL GET YOUR ATTENTION

Two F-4s making a formation landing touched down normally. Shortly after the wingman deployed his chute, lead's aircraft began to vibrate heavily and swerved to the left. Fortunately, the wingman was on the right so lead's only concern was to get his aircraft stopped, which he did without further difficulty. This could have been a much more serious mishap. That's why such failures should be a part of every formation briefing where a wing landing is contemplated. How about yours?

IT'S THE LITTLE THINGS . . .

During his preflight of a KC-135, the crew chief pulled on the bungee cord for the pitot tube covers. The cord on the pilot's cover came loose and the cover remained on the pitot tube without the crew chief noticing that the cover had not been removed. When the aircrew performed their preflight, the pilot noticed the pitot cover and asked that it be removed. The assistant crew chief agreed to do so but in the press of the launch forgot. The pilot did not check to be sure the cover had been removed. Due to the color of the covers (brown), the SOF did not see the cover installed when he checked the aircraft. On takeoff roll, the aircraft aborted when the pilot's airspeed indicator did not work.

GOTCHA

The C-141 was being vectored for landing. The crew was aware of the presence of thunderstorms and had requested avoidance vectors. During the vector, the aircraft penetrated an area of moderate turbulence and hail which caused some damage to the radome and leading edge areas. Air traffic control radars cannot always "paint" areas of severe weather.

OPS TOPICS

ASSUMPTION

The T-37 had been working in the GCA pattern at the auxiliary field. Several times during the pattern work the crew had been advised of traffic which was always low flying "crop dusters." So when they were advised of traffic during climb out on departure the crew was not particularly concerned. Because of the previous experience with the low flying agricultural planes, the IP did not request avoidance vectors even though he did not see the traffic called to him. In this case the traffic was at 7000 feet (co-altitude with the T-37). The T-37 crew saw the civilian aircraft barely in time to avoid collision. The aircraft passed about 100 feet from each other.

A SUDDEN STOP

An Aero Club instructor and student were flying a Citabria on a sightseeing flight. They had completed a portion of the flight and were flying low level over a remote riverbed when the main gear struck the snow and the aircraft cartwheeled. The instructor was attempting to maintain his crop dusting proficiency. However, he was flying over a level, snow covered riverbed with insufficient references to discern his altitude.

STOPOVER FLIGHT PLANS

There have been two cases of confused clearances recently which merit attention from aircrews. In both cases the flight plan called for a stopover at the same base twice in the same day. On the first stopover the crew confirmed their clearance with the clearance delivery facility but on departure they discovered that, although they had been "cleared as filed," the Center thought they were enroute to a different destination—the one they had filed after the *second* stopover. While mistakes can happen, no matter what, the aircrew can minimize the chances for such a mixup by identifying the destination airport each time they request activation of a stopover flight plan leg.

WAKE TURBULENCE

As the pilot of a Cessna 172 was making an approach to a big civil airport, he noticed that an air carrier DC-9 was preparing to take off on the parallel runway. Just prior to touchdown the Cessna pilot saw the DC-9 had lifted off on the parallel runway. Seconds later the Cessna abruptly rolled right. The pilot recovered and after the 172 rolled straight for a few feet it began to drift off the right side of the runway. The pilot was unable to control the drift and so shut down the engine. The DC-9's wake turbulence caught the Cessna just as it touched down. No wake turbulence advisories had been issued since the DC-9 was not designated as a "heavy" jet. ★









The

Next to a parent, the IP may be the most important person in a pilot's life. He plays many roles—teacher, confessor, judge, disciplinarian, friend, advisor, and so on. Depending on his skill and dedication to his job, he can help a raw new student become a pro, or an experienced pilot training in a different aircraft become truly proficient. Without these attributes, one would surely fail as an IP.

Since we feel the job of the IP is so important, we have solicited and received articles on the role of the instructor pilot from Air Training Command — for the UPT instructor — and other commands for the somewhat different problems their IP's cope with.

This month's article from ATC will be followed next month by one from the 4018 CCTS (SAC) at Carswell AFB, Texas.

The ATC IP's situation is somewhat different from that of his counterpart in the operating commands. His students have virtually no experience base to rely upon. He is working at a more basic level, and at the beginning of development of professionalism. This difference is amplified by the lower experience level of the ATC IP force. Currently about 55 percent of UPT IPs are on their first rated tour. However, the ATC IP's responsibility to his students and the Air Force is the same. In addition to instructing, he must accomplish three more subtle tasks. First, he

Instructor Pilot

CAPTAIN FRANK B. MERCY, Air Training Command, Randolph AFB TX

must set an example in his own flying. Second, he must ingrain a strong sense of air discipline and professionalism in his student. Third, he must be the manager of his students, not only of their flying development but of their physical and mental condition as well.

Although flying instruction consumes most of an IP's efforts, the other three areas can be more difficult due to the lack of help. They do not lend themselves to academics, textbooks, and learning centers.

The first area, that of setting the example, is usually not as great a problem for a recent UPT graduate. However, a pilot with previous experience has developed many short cuts and techniques that are not appropriate for someone with little time in the aircraft. To be an effective IP, he must frequently fly the aircraft differently from how he would if he were a "line jock."

The second area, that of instilling a strong sense of air discipline and professionalism, is related to the first in that these two subjects are more effectively taught by example. Because they're so intangible, more a "frame of mind," it is probably the most critical of an IP's responsibilities. They must be learned at the very beginning. It is relatively easy to correct a flying weakness, for example, in TACAN penetrations. However, correcting a weakness in discipline or an unprofessional attitude is a monumental task for a flying supervisor. If the IP force fulfills this responsibility, flying supervisors should never have to face that problem!

The third responsibility, that of student manager, has a tremendous impact on an IP's effectiveness. Even though the students normally may be able to manage themselves, the IP must assume this responsibility. The student devotes most of his concentration to the mechanics of flying. This, combined with the drive to succeed, will often impair his judgment in making training management decisions. Also, the IP has the necessary power to resolve conflicts in the training situation such as academic load, flight scheduling, etc.

Among the many problems an IP faces, probably the biggest in ATC is building judgment in the necessarily "canned" environment. To build judgment, the IP must expose his student to as many decision making circumstances as possible. It is very easy to do a task the same way every time rather than vary each situation within our training limits.

Exposing a student to decision making brings up the question of how far to let him go. Obviously jeopardizing safety is too far. However more subtly, is it necessary to let the student land in the overrun, or land minimum fuel to learn these are not the right ways to do it? The IP must remain constantly alert for any unexpected situation. Most discussions of, "How far?" ask more questions than they answer. It boils down to the fact that each IP must thoroughly think this question through on the ground, establish limits and apply them as he monitors his students in the air.

One insidious trap is the complacency that the "golden hands" student can lull the IP into. After he has demonstrated superior proficiency in a maneuver, there is a tendency to think of him as competent. That's when he can surprise everyone with a momentary lapse in ability or judgment!

One IP responsibility that is difficult to measure is emergency procedure training. Even with trainers, tests, and ground evals, it's hard to determine how a pilot will react to a real emergency. The IP can do two things to help prepare the student. First he must ensure the complete mastery of all procedures, and of aircraft systems. This is the base for not only the correct action, but for the confidence in his ability to handle the situation. Secondly the IP must strive to present and instruct emergency procedure practice as realistically as possible. Often operational limitations and safety considerations restrict the realism of practice emergencies. When these limits are encountered, the IP must point out their effects, and how a real emergency would differ. If the basis of this instruction had to be condensed, it could be found in our Dash Ones. Basically, number 1, fly the airplane. Number 2, make timely accurate judgments for the situation. ★



HAVANOUT

BARNEY "B" BRYANT, USN (Retired)

We could relax, sit back, and enjoy 100 percent absolute, undeniable aviation safety if we were willing to pay the price. The price would be the grounding and isolation of all aircraft with no physical contact of any kind.

This is, of course, ridiculous. What then is "acceptable?"

The education and training of intelligent people who work with, in, or around aircraft should be pursued so that no unexpected situation shall develop that has not been considered from the safety of a desk, an armchair, or the simulator.

There will always be that remote condition where no human effort can foresee the failure of a part or particle that is going to set up an emergency condition. Who can forecast engine failure while he is crossing the upwind end of the runway? The failure of a brake line during rollout, loss of the tail rotor in a maximum performance hover? The list can go on and on. The saving factor is that under each set of circumstances there is, usually, a choice of alternatives available so that recovery will result in the least amount of injury or damage.

This is where the educated, trained, intelligent being takes over. The alternate courses of action have to be considered, the correct choice selected, and the necessary action initiated, all within a fraction of a second.



This brings us to our key word or phrase for the day, "Havanout." In the armchair engrossed in thought, on the bar stool "hangar-flying," or at a desk is the place where you exercise your intelligence. This is where you develop the answer to "what if?" From engine failure on lift off to your lighter running out of fluid, this is where you develop your "out." Land straight ahead—wings level, or use those book matches from the motel, but you "Havanout." Throughout your daily life, on the freeways, at home, or in the cockpit, the thinking man will have an out for that fire, engine out, or sleepy driver. Whatever emergency develops—

"Havanout!" ★

ABOUT THE AUTHOR

Mr. Bryant was a Navy pilot for 1[illegible] years. Since retiring, he has flown the FAA for the past 15 years number of fixed wing aircraft helicopters.



the light that NEARLY failed



CAPTAIN MICHAEL J. POLAY, 3d Tactical Fighter Wing (PACAF)

I was the Instructor Pilot in the rear cockpit of an F-4 on a Ground Attack Night (GAN) mission to the gunnery range. In the front cockpit was a student aircraft commander on his second non-flare GAN mission. Number two aircraft was managed by a student crew.

I briefed the mission using the TAC briefing guide. Special items covered were: weapon preflight, night navigation, delivery parameters and techniques, and human cockpit engineering problems during night flight. The last item was very important since the F-4 has a very poor night lighting system.

Start, taxi, takeoff, and acceleration to the navigation start point was normal. During the first leg, I could see that the route would be very scenic due to great visibility. We turned north and had no problems climbing to our cruise altitude of 16,000 feet MSL. At altitude, the view was breathtaking. We could see lakes, many cities and towns.

Finally we switched to the range frequency and got ready for our bombing passes. Fuel was checked, aircraft trimmed up, gunsight turned on, armament switches set up and all crewmembers ready for the briefed six bomb passes—three high angles and three low angles.

The first two passes were normal—the bombs impacted somewhere on the range. Downwind, base, roll-in, and final for the third pass was also normal, but on pull-out, I heard the aircraft commander say, "The right fire light is on."

While he was recovering the aircraft from the dive, I got out the checklist. Above safe ejection altitude we accomplished the checklist items. When the throttle was retarded to idle, the light went out and since we had no other indications of fire, we left it there. We then declared an emergency and flew direct to our base. Recovery was accomplished with a single engine GCA and the landing was uneventful. The bad engine was shut down during the landing roll-out and the aircraft was fully secured in the dearming area. Prior to returning to operations for the flight debriefing, we stopped off at maintenance and let them know the condition of their aircraft.

So far this seems like a normal mission that was slightly complicated by an emergency. The mission was briefed and flown in accordance with TAC regulations. The emergency was handled according to Dash One procedures and the bird was brought home with no further problems.

The abnormal conditions surfaced during the flight debriefing. During the routine after flight discussion, the AC remarked, "I am glad that the fire light illuminated when I was pulling off the target and not at some other time."

I then asked the age old question, "Why?"

The shocker followed. "Because I had put tape over the fire light so that if it came on, it would not be too bright and bother me. With my head in the cockpit, I was able to see it."

Needless to say, I could not believe what I had heard. Who would ever think that the fire/overheat light would be taped over and defeat one good feature of the F-4 lighting system.

I thought about this incident for many days in order to fully comprehend what happened and why. I came up with two conclusions—one bad, one good.

First, as an experienced pilot, I was not aware of all of the problems that inexperienced pilots have. In numerous briefings this young student aircraft commander was briefed on the techniques of taping up bright lights in the F-4. So he taped up the fire/overheat light that night and he (and I) were lucky that he saw it when it came on. Imagine what the consequences would have been if it was a real fire light and he did not see it for a minute. If I was aware of the problem, I could have told him not to tape up the light.

Secondly, we must build good habit patterns. The student aircraft commander had his head in the cockpit right after bomb release until full recovery. This allowed him to see the light. Luckily, he heeded all of his night briefings and developed his good habit pattern of recovering on the gauges.

The good habit pattern does not negate the taping up of the light. It was just a coincidence that the two events occurred at the same time. The fact remains that we must be aware of problems and build good habit patterns. ★

ABOUT THE AUTHOR

Captain Polay is an alumnus of the University of Buffalo. He graduated from pilot training at Laughlin AFB, TX, in 1967 and has flown T/AT-33s and the F-4. At the time of the incident related in his story, Captain Polay was an IP in an F-4 RTU. He is currently Chief of Flight Safety for the 3 TFW, PACAF.



MAIL CALL

Sorry gents, the Martin Baker seat in the F-4 on page 6 (April 1976 *Aerospace Safety*) is an old H-5 not an H-7 as indicated on page 7. True it's nit pickin', but at least it proves someone is reading your mag.

DOUGLAS C. NELSON, MSgt, USAF
1st Field Maintenance Squadron (TAC)
Langley AFB VA

1. I enjoyed your article and pictures of Doolittle's Tokyo raid (April 1976 *Aerospace Safety*) very much. However, I would like to add one important bit of information.

2. On the back page of the magazine you show several pictures including one of Doolittle's own crew. The officer standing to the right of Doolittle is not identified but he had one of the most important roles in the mission. He was the navigator/bombardier. That man is



Col (Ret) Henry Potter who was a 1st Lt at the time of the raid I believe.

3. You have an excellent magazine; keep up the good work.

JAMES D. CAVEN, Captain, USAF
63d Tactical Fighter Squadron (TAC)
MacDill AFB FL

Thank you for your letter and copies of the *Aerospace Safety* magazine (March 1976 Well Done Award) which arrived just yesterday. It has been just over a year since the incident occurred and I see progress already in the field of bird resistant windscreens as reflected in the same issue in the article written by Lt Col Frank Pyne. I was very lucky that the bird (later identified to be a mature Golden Eagle) struck the radome prior to glancing off the windscreen. If the Eagle had hit the windscreen full force, I'm sure that the results would have been very seriously different. As it was, with a windscreen that was structurally as flexible as a wet noodle, I was able to recover and land the aircraft. If the Air Force can procure a windscreen and a compatible canopy that can withstand the impact of a bird strike without degrading the ability to see safely, then one incident such as mine is well worth the expense.

JAMES D. THOMPSON, Captain, USAF
366th Tactical Fighter Wing
Mountain Home AFB ID

Our weapons need to be as sharp as we can make them. We must be careful that in the name of safety we don't restrict, inhibit, or change the capability to such an extent that the weapon is no longer sharp nor will it win any battles.

Consider the sword. You need one with sharp edges and a pointed end and one as long as your arm. Now if Safety comes along and says that it can only be as long as your little finger, and the end must be blunt because you might stick yourself, and the edges rounded so you won't cut yourself, then you will have a sword which will be quite safe, provided you don't try to swallow it. A bigger handle will fix that.

Now to really make the sword safe, make it tough so it won't break in battle; make it flexible, not brittle; make it so it won't rust and of a material so that you can keep it sharp. And give it to a guy who knows how to use it and isn't afraid that he might cut himself.

JOHN D. BABINSKI, Col, USAF
Chief, System Safety Division
Directorate of Aerospace Safety

35th REUNION—The 2d Aircraft Delivery Group will host a 35th Reunion 13 and 14 August 1976 at Langley AFB, VA. Former members of 2 ADG, 4440th, 1708th, etc., are invited. For details call Lt Cols Bill Watson or Hank Zimmerman at 804-764-5967, or write to 2 ADG, Langley AFB, VA 23665. ★

TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



CAPTAIN JAMES R. COLE

354th Tactical Fighter Wing

Myrtle Beach Air Force Base, South Carolina

On 1 December 1975 Captain Cole was number two in a flight of four A-7Ds scheduled for a night air refueling mission. Single ship takeoffs were planned and all ground operations were normal. The night takeoff phase was uneventful until just after lift-off when, passing through 155 knots, Captain Cole heard a loud "bang" and felt severe engine vibrations. The number of options was limited—immediate ejection, continue takeoff and make a precautionary landing with a damaged aircraft, land straight ahead on the remaining runway. He chose the latter. Since he had not retracted the landing gear, Captain Cole retarded the throttle to idle, and perfectly executed an idle power approach to touchdown. Immediately thereafter he lowered the tail hook in anticipation of a departure end barrier engagement. His braking attempt at this high speed had little effect. He successfully engaged the first available barrier thus providing an additional safety margin in case of hook skip or barrier failure. Postflight inspection showed ingestion of a large bird, causing massive engine damage and a six-inch hole in the air inlet extension. The severe engine damage may have necessitated ejection had Captain Cole continued his takeoff. Captain Cole's timely reaction to a critical emergency during a night takeoff prevented the loss of a valuable aircraft. WELL DONE! ★

USAF SAFETY TROPHIES

FOR DISTINGUISHED CONTRIBUTIONS DURING 197



Chief of Staff INDIVIDUAL SAFETY AWARD

Presented to Air Force personnel who made exceptional contributions to safety during the previous calendar year.

CAPTAIN EUGENE G. LA MOTHE, USAFE

SMSgt LAWRENCE B. BUCHANAN, ADCOM

TSgt RICARDO M. GUERRA, SAC

GS-11 STANCIL R. HARDISON, TAC



The Koren Kolligian Jr. Trophy

Recognizes an outstanding feat of airmanship by an individual crewman who by extraordinary skill, exceptional alertness, or ingenuity averted an aircraft accident or minimized the seriousness of an accident.

CAPTAIN ROBERT C. HELT, SAC



The Colombian Trophy

Recognizes outstanding achievement in military aviation safety by an Air Force unit involved in tactical air operations.

388th TACTICAL FIGHTER WING, PACAF—currently TAC

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Safety Awards 1975

MISSILE

AAC	21 Munitions Maintenance Sq
	5010 Consolidated Aircraft Maintenance Sq
ADCOM	5 Fighter Interceptor Sq
	10 Aerospace Defense Sq
	84 Fighter Interceptor Sq
	318 Fighter Interceptor Sq
	4751 Air Defense Sq
	4756 Munitions Maintenance Sq
AFSC	Air Force Eastern Test Range
NGB	120 Fighter Interceptor Gp
	144 Consolidated Aircraft Maintenance Sq
	141 Fighter Interceptor Gp
	142 Fighter Interceptor Gp
TAC	4 Tactical Fighter Wg
	33 Tactical Fighter Wg
USAFE	86 Tactical Fighter Wg
SAC	19 Bombardment Wg
	28 Bombardment Wg
	42 Bombardment Wg
	68 Bombardment Wg
	319 Bombardment Wg
	320 Bombardment Wg
	90 Strategic Missile Wg
	91 Strategic Missile Wg
	308 Strategic Missile Wg
	381 Strategic Missile Wg
	1 Strategic Aerospace Div
	99 Strategic Reconnaissance Sq
	100 Strategic Reconnaissance Wg

EXPLOSIVES

AAC	21 Munitions Maintenance Sq
ADCOM	Air Defense Weapons Cntr
NGB	181 Tactical Fighter Gp
PACAF	400 Munitions Maintenance Sq
SAC	28 Bombardment Wg
TAC	57 Fighter Weapons Wg
USAFE	26 Tactical Reconnaissance Wg

NUCLEAR

ADCOM	Det 5, 425 Munitions Support Sq
	318 Fighter Interceptor Sq
AFLC	3097 Aviation Depot Sq
MAC	6 Military Airlift Sq
SAC	319 Bombardment Wg
	341 Strategic Missile Wg
	308 Strategic Missile Wg

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The Inspector General, USAF

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AUGUST 1976 AFPR 127-2 VOLUME 32 NUMBER 8

FEAR OF THE FIRST BRICK



LT COL JIM LEARMONTH
Directorate of Aerospace Safety

"There is nothing more useless than the altitude above you, the runway behind you, and the fuel you don't have." The runway behind you and what *you* have allowed to happen while it was getting behind you is what I'm concerned about.

During the last year, I've become more familiar with and concerned about landing and rollout problems as they relate to the T-39. We continue to learn more about T-39 hydroplaning, and almost any meeting of T-39 pilots now includes another pronouncement on landing and stopping (some of questionable validity!), followed by a heated discussion. We have heard proposals of thrust reversers, antiskid brakes, drag chutes, ad nauseum. I would like to add some light to the discussion without adding any heat.

The three important phases of landing on a wet runway are: landing, braking and directional control. But first, plan the approach. Plan to land on the runway most nearly aligned with the surface wind. Calculate the correct final approach (minimum run) speed and fly it to the planned touchdown point. Now relax. Let's look at the problem remaining. Once on the ground, the important relative values are: RCR, runway length (in front of you), runway direction, and ground speed. Let's take a specific example: 2000 feet pressure altitude, 30 degrees C temperature, 15,000 pounds gross weight, no wind, RCR 10. The optimum braking, flaps down, S/B open is 4150 feet ground roll. Now that's not bad, but we can't all use optimum braking. Even 50 percent of optimum should give us an 8300-foot ground roll. This should be no problem on a 10,000-foot runway. You notice I'm speaking of ground roll, for the problem is strictly a ground speed problem. If you have executed a good minimum roll/wet or slippery runway landing, you are as near the approach end of the runway as possible at between 95-100 knots ground speed.

The next problem is maintaining the aircraft on the same ground track as the runway while it decelerates to taxiing speed, *using the entire runway length.* Your anxiety to stop the aircraft can become your greatest enemy during the landing rollout. Directional control is difficult in wet runway conditions and almost impossible with one or more blown tires. Structural damage to the aircraft is almost a certainty when the airplane leaves the hard surface traveling sideways. Going straight ahead off the end of the runway at moderate speed is by far the lesser of two evils.

Let's review the technique which I've proposed.

1. Land on speed as near the end of the runway as possible. That fits the title, "USE THE FIRST BRICK," but be sure to also use good judgment and don't take a chance on landing short.

2. Use the entire runway and moderate braking effort to stop.

3. If it becomes obvious the aircraft is not going to stop, maintain directional control and ride it out straight ahead (unless there is some overriding consideration).

Maybe in the future we will see incident reports that end like this 1971 mishap at Wiesbaden, Germany, ". . . braking action remained zero until 1500 feet from end of runway. At that point, braking became sporadic and the aircraft began to fishtail. The pilot decided he would be unable to stop safely on the available runway. He straightened the aircraft out and allowed it to roll 375 feet into the sod overrun where it stopped *undamaged.*" AND USE THE LAST BRICK TOO. ★

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SO NOW YOU'RE AN INSTRUCTOR PILOT!



MAJ DONALD E. YARBROUGH
4018th Combat Crew
Training Squadron
Carswell AFB TX

Second In A Series

So now you're an instructor pilot! You've completed all the tests, passed your check ride, and been certified by your commander. Your prestige has just jumped up a notch or two, and you're probably well satisfied with your accomplishment. Rightly so. However, are you aware that your chances of becoming an accident statistic have increased along with your status?

"Why," you ask? "I'm more proficient, more knowledgeable and more qualified than ever before. I should be less likely to be involved in an accident."

You're right, you should be safer than the average bear, but the statistics show that isn't the case. IP's have their own special place in the accident stats. They experience an

accident rate out of proportion to their numbers. For a lot of reasons, you could be another instructor-involved accident just waiting to happen.

"Oh yeah, you're going to tell me about increased exposure and all that. I've read about how instructors are exposed more often and for longer periods of time to the more hazardous phases of flight than anyone else. That must be what you're driving at."

Well, yes, increased exposure is one of the things I had in mind.

There are several others, too, if you're interested?

"Go ahead, over."

Thought you'd never ask. You see there are a number of hazards that an instructor must live with that don't affect the average crew dog. There are others that affect both, but are felt by the instructor in a different way. It's these hazards that are peculiar to the IP's task that you need to know about. They have been discovered the hard way by your instructor and his instructor and his instructor before that.

You've already mentioned exposure. Along with increased exposure goes *fatigue*. Fatigue brought on by an instructor's constant high level of physical and mental activity is the particular kind of fatigue I'm talking about. The instructor pilot on board any aircraft feels responsible not only for his activity but for the actions of everyone else as well. He must be constantly paying attention to the actions of the student and all the while making sure that essential tasks are performed correctly. The stress brought on by increased activity causes the instructor to become fatigued faster than anyone else on board.

You're aware, of course, of how fatigue can have an adverse effect on one's judgment, perception and reaction time. Here's our IP on final approach at the end of a six hour pilot-pro: He's thirsty, hungry and his bladder is about to burst. His



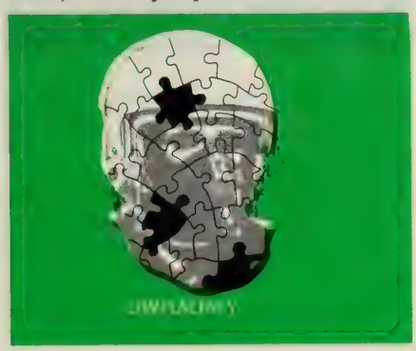
students have been in and out of the seat for relief a couple of times or more, but not our IP. He's been too busy minding the store and keeping the whole ball of wax together. Think about it.

Then there is a special hazard I like to call the *Student Syndrome*.



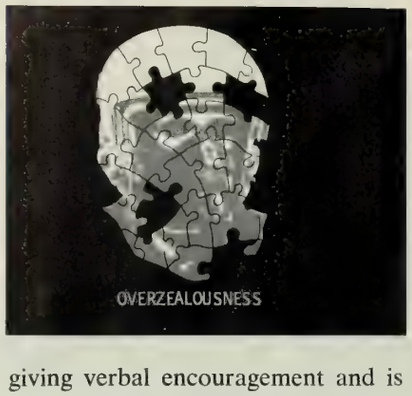
It's a fancy label for a type of mental set experienced by a student when he's flying with an IP. He tends to depend on the oldhead IP to make, or at least review, the decisions that are made. He will sometimes do things with the airplane that he would never do if he weren't "backed up" by the IP. His decision making process is almost always altered by your presence. He nearly always considers what he thinks you want before he reaches a decision on anything. All this flip flop thinking takes time. Here he is closing on the tanker: *Damn, I've never closed this fast before, but my IP doesn't seem to be worried.* Meanwhile, our IP thinks: *Looks like a high rate of closure to me, but I'll wait a little longer to see if he corrects.* Think about it.

Complacency is a tender trap that has killed many aviators, but it has a special meaning for instructor pilots. It's the root of that old saw, "It's the good student that will kill you." You can be lulled into complacency by a pilot who has been showing you a flawless performance. You may forget why you are on board. It can be a temporary, but fatal, memory lapse. Think about it.



Most of the time while you are flying as an instructor you will really just be watching. The other guy will be moving the controls. It is possible for him during critical phases of flight to make control inputs so quickly and so wrongly that recovery actions, even if initiated as quickly as is humanly possible, may not be soon enough to avert disaster. This is a *control environment* that you live in as an instructor. Guard the controls, expect that other guy to make mistakes with them, and take the airplane at the first sign of a deteriorating control environment. Consider, also, that each time you change students the control environment will change. You must adapt to that change. Adapting places stress on you. The more frequent the change the greater the stress. Think about it.

Overzealousness has taken its toll of eager young instructors. They want to do such a fine job, are so concerned that their student gets the full benefit of their expertise, that they completely overlook routine actions. Here's the overzealous instructor: He's talking his pilot through one of the best ILS finals the world has ever seen. Right on glide slope, the VVI is painted on, power changes are minute. He is



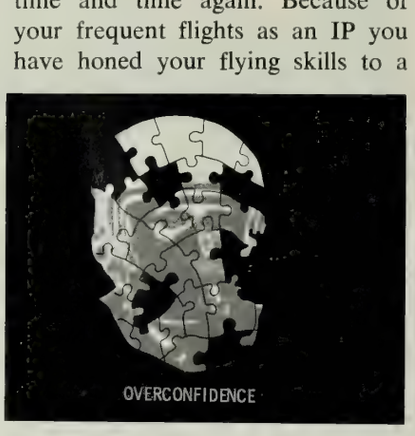
giving verbal encouragement and is reenforcing the learning process of the student by earned praise in the best possible manner. The only thing wrong is our instructor has forgotten to put the rollers out! Think about it.

Pressure is one of the seldom mentioned items that can start you down the primrose path. Real or imagined, it makes no difference. It makes you do things you wouldn't



ordinarily do. It can come from many directions to force you into a coffin corner. From scheduling: "Get this guy his night heavyweight or you're going to be pulling alert for him next Thursday." From the command post: "The DO wants you to try those flaps a few more times because he thinks it's an electrical problem and not a jammed segment." From the student: "Isn't the weather good enough for just one more approach, sir? I need it to finish my upgrade requirements." From yourself: *I've got to show this guy the superb skill that makes me an IP*. Think about it.

After a year or so of instructing you might feel like you've seen and done it all. You've had your share of hairy recoveries, you've seen all of the mistakes the students make time and time again. Because of your frequent flights as an IP you have honed your flying skills to a



razor's edge. You take great pride in demonstrating aerial maneuvers with flawless precision. There is still one little hazard that may trip you. OVERCONFIDENCE. Think about it.

Up to now I've been busy giving a lot of reasons why instructor pilots are involved in more than their share of accidents. Really, though, these things don't *cause* the pilot error accident that I'm talking about. The accident in which the instructor and student let a flyable machine make unscheduled ground contact is caused by DISTRACTION. All the things I've talked about so far are only some of the many ways an instructor pilot can become distracted. Distracted from what? From flying the airplane, of course.

Now, there is another aspect of flying and flying accidents that you might consider. It deals with a characteristic of humans called emulation. By that I mean that some of your attitudes will rub off on your students. Your attitudes toward professionalism, safety, and air discipline are particularly important for your student's continued safety. If you, by word or deed, show him that rules are made to be broken, that attitudes of "safety first" are to be sneered at, or that bravado is a substitute for disciplined airmanship, you may be setting him up for disaster at some point in the future.

The more impressive and liked you are as an instructor the more likely your students are to acquire your attitudes. Probably, no one will come back to you with an accusing finger after a former student of yours bites the dust, but you'll have to sleep nights, won't you? You'll be asking yourself questions like these: "Did I teach him everything I could in the time I had available?" "Was he emulating me and my attitudes towards safety, discipline, and airmanship when he crashed?" Think about it.

I don't have all the answers for you. I don't suppose anyone has. I do, however, have a few broad guidelines that I think will improve your chances of collecting your retirement.

- AVOID SURPRISES.
- FLY ONLY AIRWORTHY EQUIPMENT.
- KNOW YOUR PROCEDURES, AND INSIST THAT EVERYONE YOU FLY WITH KNOWS HIS.
- AVOID THE PITFALLS THAT LEAD TO DISTRACTION.
- FLY THE AIRPLANE.

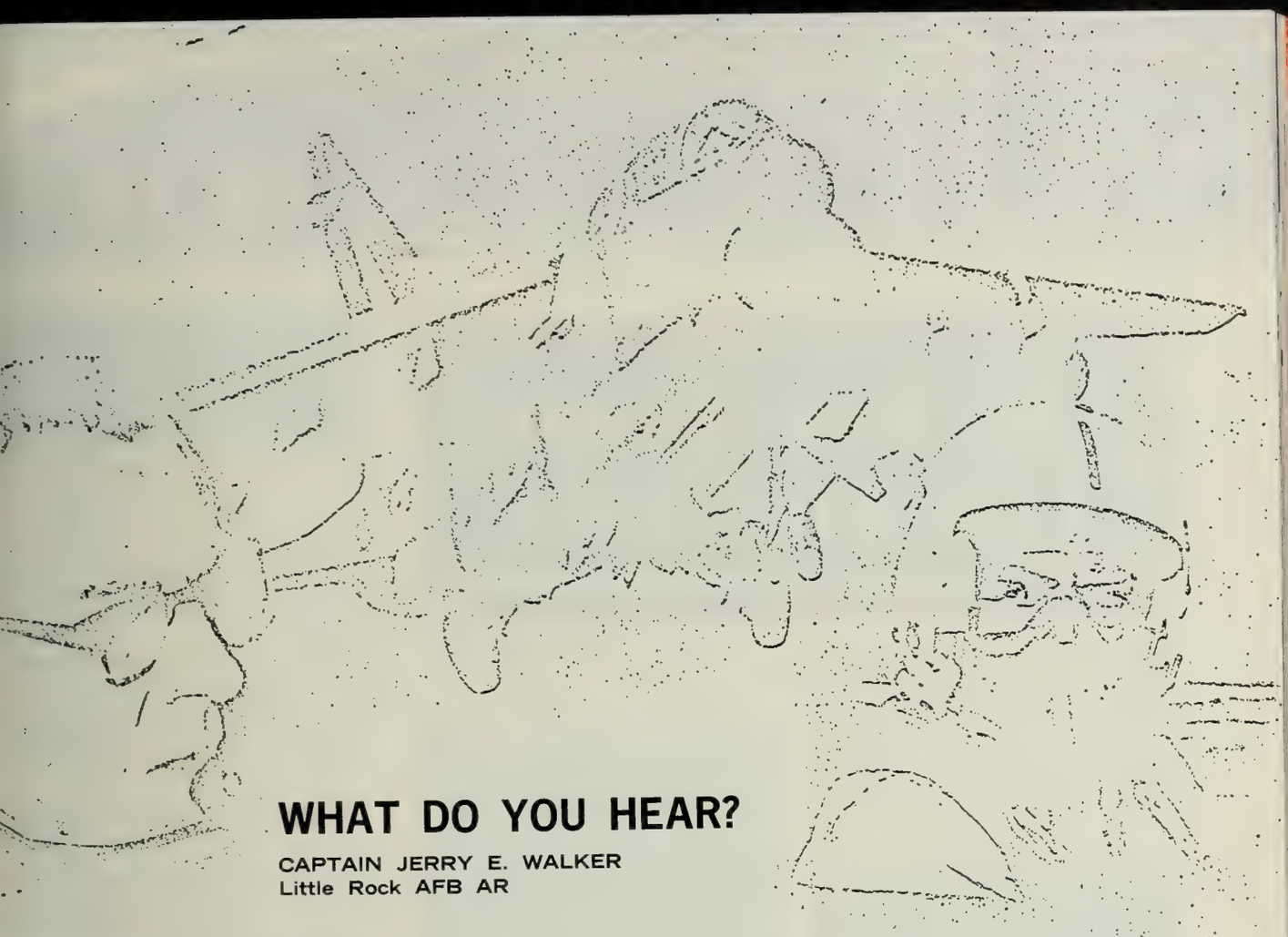
THINK ABOUT IT. ★



Keep It All Together

ABOUT THE AUTHOR

Major Yarbrough has logged almost 5,000 total flying hours, most of it in the B-52. In 1967-68 he was assigned to the 1st Air Commando Squadron, Pleiku RVN, where he flew 211 missions in the A1E, Skyraider. His B-52 time includes over 1700 B-52 hours as an IP in the units, at CCTS, and in CFIC. Major Yarbrough will voluntarily retire from the Air Force 31 August 1976.



WHAT DO YOU HEAR?

CAPTAIN JERRY E. WALKER
Little Rock AFB AR

Investigation of a Hazard Report concerning approach clearance confusion indicates the need for greater pilot awareness.

An aircraft was cleared during letdown for an ILS approach. The weather at destination was 700' ceiling with 6 miles visibility. The pilot was subsequently notified by Approach Control that the ILS was out of service, so he requested a PAR. Several minutes later Approach replied, "Callsign, say you'll take an NDB." The pilot replied, "Roger, request PAR if available."

When the pilot said "roger" the approach controller wrote NDB on his strip and then cleared the pilot for a PAR approach. Approach Control passed the aircraft to GCA as an NDB approach. The pilot requested and received "Lost Comm" and "Missed Approach" instructions from GCA. This action further led him to believe that he was receiving a PAR.

At the radar final approach fix the GCA controller made the required gear check and advised the pilot that glide path advisories would not be provided. The pilot continued on his last assigned heading and altitude.

The GCA controller advised the pilot that he was well left of course and asked if visual contact had been made with the runway. The pilot made a negative reply and the GCA controller requested that missed approach procedures be executed. The pilot replied that he was on a PAR; he probably thought that he would receive instructions at any moment. The aircraft proceeded off the PAR scope and GCA cleared the pilot to land. When the pilot flew past the airfield, the senior GCA controller took charge and directed a missed approach. The elapsed time between the initial request for missed approach and the initiation by the pilot was one and one-half minutes. The fact that the pilot continued on last assigned altitude probably averted a disaster.

This incident highlights the philosophy that accidents are the result of a chain of errors.

The approach controller erred in passing the pilot off to GCA as an NDB when in fact the pilot had been cleared for a PAR. The GCA controller erred in not positively directing the pilot to execute missed approach instructions when it was evident that the pilot was not conforming to any published approach. The pilot erred when he complacently continued an approach after receiving numerous radio calls that should have caused some doubt as to the validity of the approach.

In conclusion, listen for what is said and not what you want to hear. ★

THE IFC APPROACH

Do You Know The Answer??

A look at our recent articles reveals that it has been awhile since we have had a quiz. The following are queries that we have received from the likes of ya'll. If all the questions are easily answered by you, congratulations, we hope that you are sharing your knowledge with others. On the other hand, guessing at the answers may indicate some basic gray areas and the need to get back into the books. The correct answers are listed on page 27.

1. After landing at a military aerodrome you should confirm the closing of your flight plan by:

a. Contacting Tower while taxiing down the active runway.

b. Contacting Ground Control or Base Operations while taxiing to the ramp.

c. No transmission required. Flight plan is automatically closed upon landing.

d. Either a. or b.

2. Assume you are on a stopover flight plan at a civilian aerodrome. As soon as practical after takeoff you must:

a. Contact departure control to activate your flight plan.

b. Notify the tie-in flight service station of your departure time.

c. Expect the departure time to be passed to flight service by the Tower.

d. None of the above.

3. Normally an aircraft having the right of way will maintain its course and speed. However, if the danger of collision exists, you must:

a. Maintain course and airspeed.

b. Reduce airspeed and give way to the right.

c. Reduce airspeed and descend in order to provide adequate vertical separation.

d. Take whatever action is necessary to avoid collision.

4. A radar approach (PAR/ASR) is considered a published instrument approach procedure provided:

a. Radar minimums are published in the FLIP.

b. If not operating in the PCA, aircraft position can be established within 25 miles of the terminal radar by use of a NAVAID.

c. Published minimums are at least 300 and 1 for ASR, 100 and ¼ for PAR.

d. Both a. and b.

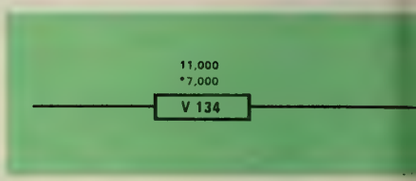


FIG. 1

5. Which of the following statements is true concerning a stopover flight plan:

a. The "route of flight" blocks must be filled out for each leg.

b. A void time is a mandatory entry in the remarks section of the DD Form 175.

c. Enroute changes in destination not reflected on the original flight plan are authorized without refiling a DD Form 175 provided clearance is obtained from ARTCC and flight service is notified.

d. All the above.

6. You wish to use King AFB as an alternate. Ceiling and visibility requirements should be:

a. Ceiling of at least 1500 feet or 1000 feet above the published minimum, whichever is higher, and a prevailing visibility of at least 3 miles.

b. Ceiling of at least 1000 feet or 500 feet above the published minimum, whichever is higher, and visibility of at least 2 miles or 1 mile above published minimum, whichever is higher.

c. Ceiling of at least 1500 feet or 1000 feet above the published minimum, whichever is higher, and visibility of at least 2 miles or 1 mile above the published minimum, whichever is higher.

d. None of the above.

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

7. US En route low altitude charts provide MEA information above the airway identification block. An MOCA (Minimum Obstruction Clearance Altitude) is sometimes shown directly below the MEA and is identified by an asterisk (See Fig 1). The designation of an MOCA indicates:

a. A higher MEA is required to insure positive NAVAID signal reception.

b. ATC may clear you below MEA but not below MOCA provided the assigned altitude is at least 300 feet above the floor of controlled airspace.

c. Descent below MEA in a radar environment is possible only if you are being radar vectored and have been issued lost communication instructions.

d. Descent below MEA in a non-radar environment is possible only if you are within 22 NM of a VOR, VORTAC, TACAN.

e. All of the above.

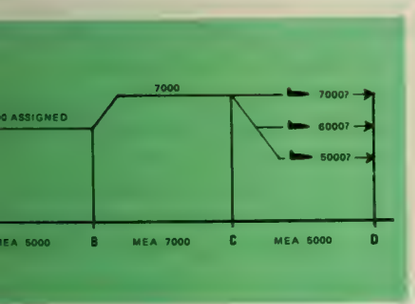


FIG. 2

8. Your last assigned altitude is 6000 feet. You are in the weather and lose communications just after point A (Figure 2). You climb to 7000 feet at point B because of the MEA. What altitude should you fly from C to D?

a. Continue from point C to D at 7000.

b. Descend to 6000 (last assigned) at point C.

c. Descend to the MEA (5000 feet) at point C.

9. During a radar approach, lost communications instructions will be issued:

a. By military controllers only.

b. When weather conditions indicate that IFR conditions will be encountered during the approach.

c. Prior to reaching the final approach fix.

d. Only when requested by the pilot.

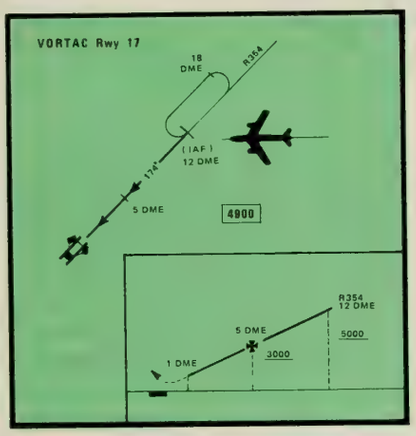


FIG. 3

10. You are being radar vectored to the low altitude IAF at 6000 feet and subsequently cleared for the VORTAC Rwy 17 approach (See Figure 8). Upon reaching the IAF at 12 DME you should:

a. Maintain your last assigned altitude (6000 feet) until established on a segment of a published routing or instrument approach procedure. Then fly the approach as published.

b. Turn immediately in the shorter direction to intercept the inbound course.

c. Start a descent to 3000 when the aircraft is abeam or past the IAF and on a parallel or intercept heading to the inbound course.

d. Both b. and c.

11. Changeover Points are used on all federal airways, jet routes, area navigation routes and direct routes with MEAs. A symbol 

is used on FLIP charts to indicate where you should change to the NAVAID ahead for course guidance. If the symbol is not depicted, the changeover point is:

a. Midway between the navigation facilities for straight route segments.

b. At the interception of radials or courses when the routing forms a dogleg.

c. Not required for route/airway segments less than 40 NM in length.

d. Both a. and b.

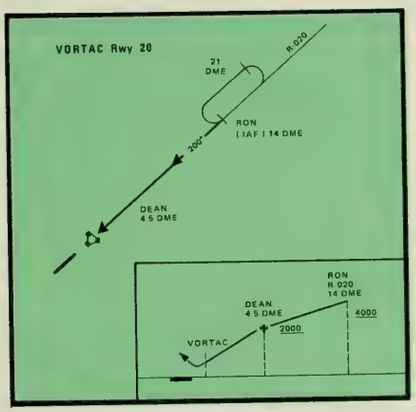


FIG. 4

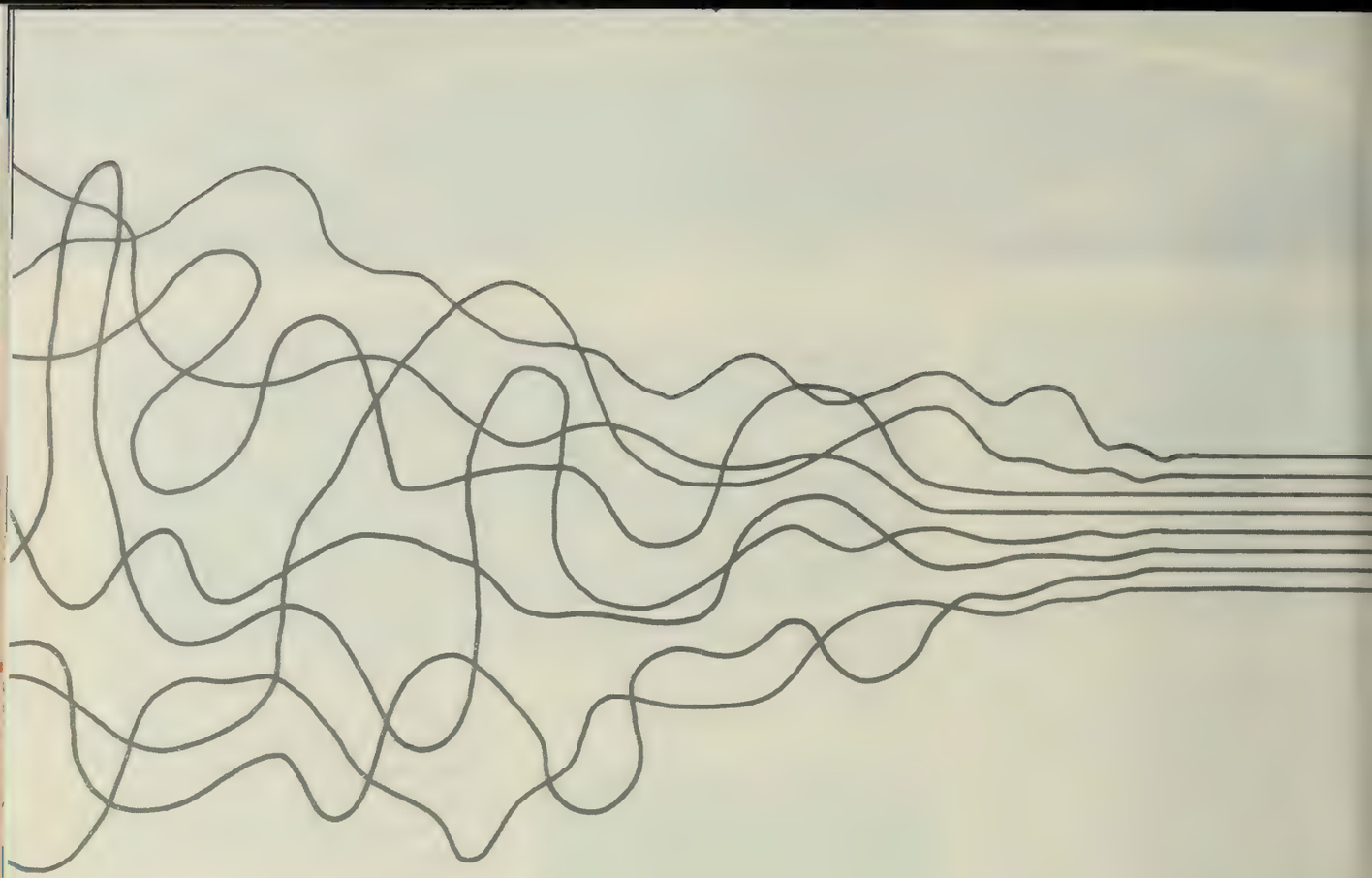
12. See Figure 4. You are established in the holding pattern at RON at 5000 feet and subsequently cleared for the approach. You are expected to:

a. Turn immediately toward the RON IAF and descend to 4000 feet.

b. Maintain 5000 feet until the RON IAF then fly the approach as published.

c. Request an ATC clearance to descend to 4000 feet prior to arrival at the RON IAF.

d. Either b. or c. ★



The accident narrative stated ". . . The pilot admitted that he was *complacent* about his ability to land safely in weather reported as '. . . ½ mile visibility with light rain and fog'" Another narrative contained these words ". . . the crew chief explained that he had become *complacent* in his review of aircraft forms"

Complacency. From time to time we see it crop up as an "explainer" or mitigating circumstance in an accident sequence. But what is it? Let's consult Webster's.

"Complacency: A calm sense of well-being and security." Sounds good, but perhaps this second definition is closer to what we had in mind: "A feeling of self-satisfaction accompanied by unawareness of actual dangers or deficiencies." Although this is the most common interpretation, the psychologist's definition is yet more revealing.

Psychologists describe complacency as a "fantasy form of living which we *all* use as a way of *protecting* ourselves from the frightening thought we might not be here tomorrow morning."* Two words in this definition are especially disturbing: All and Protecting.

The use of the word *all* connotes a certain omnipresence of the attitude. We—mankind—are all complacent in our daily living. So the first—and perhaps the most important—element of the concept is its universality. The second word, *protecting*, indicates that we use complacency as a kind of "defense mechanism." Those of us who labored through Psychology 101 remember well the other defense mechanisms—projection, rationalization and the like. And if we accept the psychologist's definition then we must also view complacency as a necessary psychological adjustment we use to occasionally protect us from a harsh, and sometimes cruel, world.

Definitions are fine but the salient question really is this: is complacency a significant problem in USAF accident experience?

This is not an easily-answered question; such questions never are. And a great part of the difficulty stems from the fact that complacency has an insidious and virtually unknown—albeit undeniable—effect on aircrews and their performance.

How can we be sure this influence is truly present? These representative examples from USAF's accident experience confirm our contention: . . . The aircraft was cleared from FL 330 to FL 100. The aircrew acknowledged the descent clearance and subsequently contacted the GCA controller for approach instructions. The aircraft's last recorded transmission was between the aircrew and the controller: the aircraft crashed into the ground moments later, was totally destroyed and 24 people were killed. One of the accident board's findings was that checklists were improperly accomplished; switches were in wrong positions; altimeters were improperly set

*Extracted from the article, "Complacency, Let's Define It," by Dr. Chaytor R. Mason.

COMPLACENCY

WHAT IT IS...WHAT WE CAN DO ABOUT IT

MAJOR T. R. ALLOCCA
Directorate of Aerospace Safety

. . . Flight was normal until return to base area. Terminal weather began to deteriorate rapidly. Aircraft was cleared to terminate early because of lessening visibility. An enroute descent to a PAR final was accomplished. The aircraft struck approach light stanchions when it touched down on the overrun; both main landing gear separated from the aircraft; the aircraft continued approximately 4000 feet down the runway and caught fire A board finding was that the pilot did not request clearance to an alternate upon initial receipt of weather below visibility minimums and he continued the approach below decision height and landed even though he had received and acknowledged weather below minimums

Checklists not properly accomplished; switches in the wrong positions; landing in weather known to be below minimums Instances such as these are hard indicators of a complacent attitude and provide real-world examples of the definition: "A feeling of self-satisfaction accompanied by unawareness of actual dangers or deficiencies." So if we agree that complacency has contributed to Air Force accidents, our next task is to suggest a remedy.

One remedy is education. Complacency is such an inherent part of our daily lives and mental make up that we're often not aware of just when and how it's affecting old Ish! So we must make people aware of the fact that complacency *is a problem.* And we can conduct awareness campaigns—you know, the kind which includes posters, films, briefings and the like. And these are excellent courses of action for "educating" the Air Force flying public. But we must do more.

We must go beyond this conventional approach and take other, perhaps novel, courses of action to counter complacency's effects. A good answer is training; but not the traditional type of training. Not the training which evokes a Pavlovian response to a checklist item; rather the training which ensures that the crew member knows what he's doing when he throws a switch or sets a dial. The training which makes aircrews think rather than react. For if we keep thinking, perhaps the tendency towards taking "short cuts" or missing steps will be less likely to occur. And if we keep thinking, perhaps the full consequences of our actions will loom brilliantly in our minds, and perhaps that "feeling of self-satisfaction accompanied . . . deficiencies" will be less likely to affect our actions.

Are these the only answers? Hardly. The dearth of literature in the area suggests that this is a most fertile area for fresh and novel ideas, for cross-talk, for brainstorming, for hangar-flying. And if we talk about it—let it surface (to speak in the Psychologist's lexicon)—maybe then we can get a handle on it.

Complacency . . . it's bothered us in the past. Let's put it to sleep. ★



AIRCRAFT EMPATHY

"Aircraft Empathy" refers to that prevalent aviation tradition that there is a special interface between man and machine without which flight becomes sterile, mechanical and, yes, dangerous. The article from "RAF Air Clues" has different terminology but the message is loud and clear. A pilot's knowledge of and appreciation for his aircraft are major factors in flying safely.

When driving your car do you:

(1) Turn the steering wheel when stationary?

(2) Sit at traffic lights in gear with your foot on the clutch and then do a racing start on the green?

(3) Drive off from cold without warming the engine?

(4) If stalled at night with headlights on, leave them on while restarting the engine?

(5) Force the synchro-cones to adjust the engine rpm when changing gear?

If you answer "No" to most of these questions then you are qualified to read on. You probably have sufficient feeling for machinery to criticise this article constructively.

If you answer "Yes" you could be one of several types:

a. You have never considered such ideas.

b. You understand the questions but consider them irrelevant.

c. You believe that all machinery is built in the service of man and ought to perform to his wishes under all forms of treatment. Further, if it breaks it should be replaced.

Type *a* might find the article revealing. Type *b* may see that if he wants his car to last longer, the questions become relevant. For Type *c* there is no hope: the article will either fall on deaf ears or the blood will boil with rage and indignation.

ASKING FOR MOON ROCKS?

The aim is not to question the habits of car owners, but to concern



those who fly aircraft in a feeling for the machinery. The quest is for aircraft empathy.

In order to get the best from an aircraft, to stay in the air longer for a tankful of fuel, to fly safer and for the aircraft to last longer, the operator must be sympathetic to the aircraft he flies. The pilot who does not have a working knowledge of aerodynamics is at an obvious disadvantage. If he does not appreciate the effect of the stress he imposes on his aircraft, he is a liability.

Aircraft empathy starts as an educated understanding of the hardware of the aircraft, and progresses to a common sense, realistic and sympathetic handling of that hardware. Philosophically, the control column becomes an extension of the hands and the instruments extensions of the brain. The aircraft becomes a mechanical alter ego.

THE NEED FOR EMPATHY

The arguments for empathy become pedantic by their repetition. However, the Service has lost the lives of pilots and many thousands of pounds through thoughtless and crude handling of its equipment.

Empathy is certainly desirable and important, there can be no argument about that. I think it is vital. I recommend that it should be considered, taught and even assessed at flying training schools.

HOW TO START

The first stage in achieving empathy is understanding. What is required is not only the essential details given in most pilot's notes, but a broad education about the valves, switches, jacks, motors and generators, pipe joints and unions, etc. Size, material, stress level, wear rate, working temperature, and the position in the aircraft of all these items should be appreciated. The aircraft structure should be studied (not necessarily to degree standard!), how it's built, where the stress paths are and what it is made of. Furthermore, knowledge need not be limited to the aircraft. There are vast areas of relevant information in such subjects as strength and property of materials, metallurgy, workshop practices, high-temperature plastics, transistor theory, and many others, all of which are building blocks for empathy.

The next step in achieving empathy is more abstruse, but can be likened to the advantage of card

AIRCRAFT EMPATHY

continued

sense for playing cards or numeracy for manipulating figures. The aircraft operator has to apply sympathetically his ever-increasing knowledge and understanding to the handling of his aircraft. This requires acceptance of the importance of empathy to the long term benefits of the aircraft. It requires a schooling of mechanical finesse to the natural manipulative skill that is gained during flying training.

The final step is to realise that perfection can never be achieved. There is a process of continual refinement, and there is a real sense of excitement and achievement in developing this mechanical other self.

ACHIEVEMENTS

The two most important achievements of the application of empathy are that machinery, which is subject to wear and failure, can be made to last longer, whilst flight becomes safer.

Reconsider the analogy of the car made in the introduction. The wear rate on cylinder walls is dependent on several factors: the number of cold starts, lubrication, and engine rpm during warm up. By adjusting driving technique and the use of the car, the wear rate can be changed by at least a factor of 2.

A driver who:

a. Idles his cold engine with full choke,

b. Drives away from cold using over 4000 rpm, or

c. Forgets to change the oil regularly,

may ruin the cylinder bores in 40,000 miles. However, the driver with mechanical sympathy who:

a. Pushes his car into the garage, if it is parked just outside,

b. Walks to the corner shop for his cigarettes,

c. Warms up a cold engine at 1500 rpm for at least a minute, or

d. Changes the oil at the first signs of degradation,

may well double the bore life of the engine. And it costs him only the oil change. Clutch and brake wear, battery life and fuel consumption all improve with empathy, at no extra charge.

Back to aircraft. The civil variant of the Avon is "lifed" at about 3000 hours, but the RAF changes the Avon at 500 hours. Obviously a fighter cannot be operated like an airliner, but the point is, a change in handling increases life by a factor of 6. Think again, though: there are aspects of the airline style that could be used for the fighter. Instead of the slam acceleration relying on the ACU, lead the rpm by a controlled movement of the throttle. Thermal shock to the turbine is reduced, fuel consumption is also reduced and the engine is accelerated as far away from the surge line as possible. Non-operational climbs could be restricted to the maximum continuous rating instead of full military power.

Throttle "pumping" in close formation is another source of engine and airframe wear. Large throttle movements which are made to produce minute corrections of the aircraft position cause unnecessary compressor blade fatigue, intake skin panting, thermal cycling of the turbine and increased fuel consumption. If a particular aircraft is two feet aft of correct station, a quarter of an inch movement of the throttle forward may marginally increase the thrust sufficiently to move the aircraft. The same quarter of an inch should be removed as the aircraft approaches its correct position. The formation result may not approach "Red Arrow" perfection but surely it's good enough for government work. An Avon costs about $250,000 and a Spey costs about $600,000; if their lives could be doubled the Service would halve the cost of engines.

Do you still need convincing that machinery should be cared for: Why break into the circuit at 6g when 4g will do? Why land 10 knots fast and force the 'chute or brakes to cope with the square-lay increase in kinetic energy? Why carry out the controls full and free checks by running the protesting hydraulic jacks and motors hard up against their end stops? Why taxi fast round corners, throwing the aircraft weight onto the outer wheels or bogies? Why wind on maximum nose wheel steering and expect the tires to hold onto the tarmac? And why risk FOD either to your own engines by taxiing close to your leader or to other engines by letting your jet wake cross parked aircraft?

CONCLUSION

Aircraft empathy involves the operator in man-machine integration. It requires a full understanding of the aircraft, its systems and the environment in which it flies. Aircraft handled with sympathy will last longer, fly safer, and will cost less to operate. (Besides which, it is more professional—Ed.) ★

From RAF AIR CLUES



Subsistence Off The Land

SSGT CHARLES R. TEAGARDEN
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Fairchild AFB WA

PART II

In Part I, Nutrition and Survival Rations, the food requirements for survival and the general purpose rations were covered. In this article, some sources and methods of food procurement will be discussed.

Perhaps the most overrated element essential to human existence is food. We go to great lengths in its production, preparation and consumption. We indulge in foods we like and discard what we dislike. But what happens when the foods we recognize are no longer available? Besides a feeling of hunger, our senses sharpen and the motivating force to procure takes over. However, the need for food, both physical and psychological, is less than we might think.

You, as a potential downed aircrew member, may one day be faced with a situation where your normal staple foods are limited. Uncle Sam has taken into account this possibility and, on most the aircraft, has provided you with survival rations in your seat or survival kit. Due to restricted space, the number of rations is limited. What happens when this supply runs out? Hopefully by then, you would have given some thought to subsisting off the land.

In any survival or PW situation, most plant and animal life is a potential food source. You can't turn your nose up just because it's never been on your menu before. Insects, as an example, can be an excellent source of food. The following list shows their potential:

This list would seem unappetizing to most people, but, it's food and may be all that is available. If you look long and hard, in most situations, you'll find something to eat.

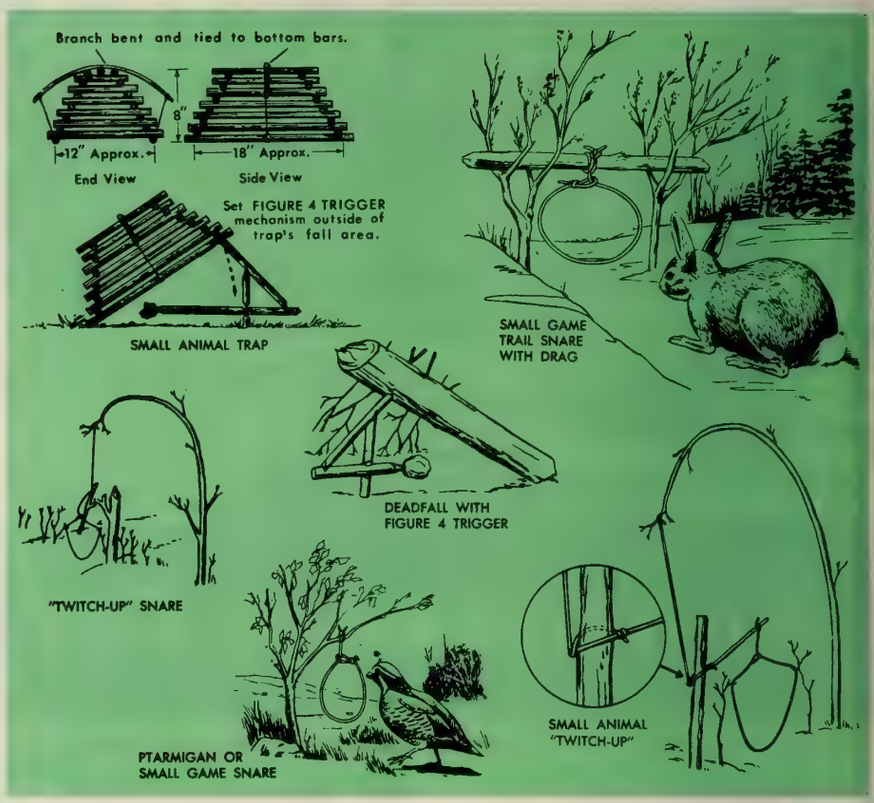
To aid in your quest for food, think about these questions and comments. What type of environment will I be in and what are some of the basic things I can do to aid myself? How much food do I need to stay alive? What are the ways in which I can procure foods?

INSECTS AS A SOURCE OF NUTRITION

INSECT	NUTRITIVE VALUE
Termites	Protein, Fat (100 grams of fried termites = 561 calories)
Caterpillars (smooth skin—any type eating non-toxic plants)	Fat, Carbohydrates
Earthworms	Protein
Silkworm and Pupae	Vitamin A, Fats, Minerals
Larvae	Protein, Water
Locusts	Protein, Fat, Calcium, Solium and Iron
Grasshoppers	Vitamins B_1 and B_2
Grubs	Protein, Fats
Water Bugs	Fat, Protein, Water

SURVIVAL: SUBSISTENCE OFF THE LAND

continued



Your environment will be the circumstances or conditions that surround you. Though you can't change your environment, you can learn to coexist with it. First, dress to fit your environment so you'll be able to cope with it. Next, check the flight path for terrain features and check with your local weatherman for the extended weather forecast. With this information in mind, you'll know what to expect and perhaps the shock of finding yourself in a hostile environment won't be as bad.

How much food you need in a "subsistence" situation (SURVIVAL) depends on three things: (1) How big you are—larger people normally require more calories than smaller; (2) How old you are—the younger person burns up a larger number of calories than the older; (3) What the climate is—more energy is required in a cold climate than in a hot one. The average individual burns up approximately 3300 calories per day just to maintain normal body functions and carry on day-to-day activities. In a survival situation, the caloric intake needed could rise to approximately 4000-5000 calories, again depending on size, age and climate.

Now that you're aware of environmental conditions and your calorie requirements, you can concentrate on foods. You could do research at your local library on the various plant and animal life of a given area or you could wait until it's too late and wish. Remember, it's important to supplement emergency rations by living off the land in any extended survival situation. Life can be sustained by hunting, fishing, trapping and gathering. Though edible plant life is often more readily available, animal life generally yields more nourishment per pound. Here is a breakdown of the various ways food may be procured and some general tips.

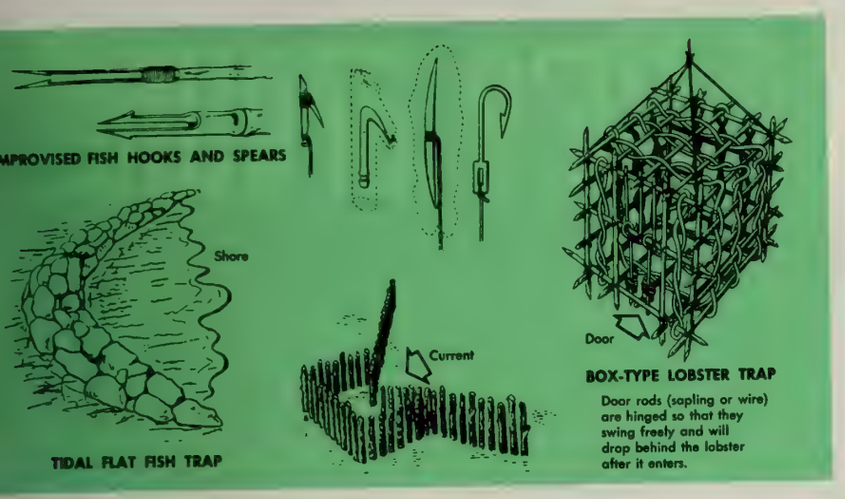
HUNTING

Hunting may be accomplished in one of three ways or a combination thereof: still hunting, stalking and blind stalking. Still hunting is a process of simply finding a place where an animal will probably pass, for example, near a trail, watering hole or feeding ground. You should hide nearby, downwind, remain motionless and wait for the game to come within range. In any case, think small. A bull moose could easily spoil your day, so stick with the bunnies and such.

Stalking is an attempt to keep some cover between yourself and the animal. This requires slow, tedious movement. Move quietly, keep downwind, avoid sudden movement, and freeze if the animal looks your way.

Blind stalking requires skill, a knowledge of the animal you're hunting, and some guess work. To blind stalk, locate a fix on the animal in relation to some easily distinguished landmark. Determine the animal's direction and rate of movement and estimate where it will be by the time you have moved to a new position downwind and within range. Your route of travel should be under cover. If you think blind stalking sounds tough, you're right, it is! But, it gives you something to do on your days off. Who knows, you might trip over an anthill on the way and, viola! Here are a few general hunting tips:

- Tracks and droppings may be



Animals provide an important and often easily accessible source of food. Traps provide a convenient way of hunting for game. The types are limited only by your resources and imagination. Some typical examples are shown on the far left. Traps also work for fish, as do homemade hooks. The picture to the immediate left shows some ideas.

indicative of the type of animal and its feeding habits.

- Feeding signs may indicate the type of animal. Watch for chewed grass or bark, peeled or scarred bark, or cropped shrubs.
- Bedding areas may indicate recent occupancy and the number of animals.

FISHING

If you have access to a permanent body of water, fish could prove to be a food source. Remember, when the water is frozen, exercise extreme caution when walking on the ice or when cutting a hole through it.

Fishing methods: Hooks are supplied in the minimal survival kit or they can be improvised. Line can be acquired from the inner core of the suspension lines on your parachute harness. Hooks may be baited with insects, worms, pieces of meat or bits of metal or cloth (a lure). Jigging uses a baited hook or lure which is dipped repeatedly beneath the surface of water. This method is especially effective at night.

Spearing and tickling fish are methods which require patience, skill and great care. Spears may be fashioned from any available material. The point ideally should have a type of barb to secure the fish. Tickling fish is an art that is easily mastered with some practice. Find a log in the water or an overhanging bank, lay parallel and reach slowly to the underside coming upward toward the bottom of the log or bank and grab the fish.

Nets and fish traps are two of the most effective ways to capture fish. Nets can be constructed from the inner core of the suspension line. Traps can be constructed from vegetation.

NOTE: Wild animals are territorial, so if a bear tries to argue with you over your catch, PLEASE lose the argument. Giving him the fish will save your life and give you another chance to find your fish elsewhere.

TRAPS

Traps are divided into three basic types or categories; mangle, strangle and hold; all are utilized with some degree of success. Mangle traps are normally used against larger animals and require more effort in their construction. They are large weighty objects, made of rocks or logs, and are designed to fall on the animal when a trip line is pulled, thus killing or disabling the animal. The strangle trap is designed to kill the animal using a simple loop attached to a twitch up or weight which will pull the animal off the ground. The hold trap is usually a box which will trap the animal when a trip line is released. Tips when using traps:

- Become familiar with the habits of the animal you are trying to trap.
- Set traps on trails, at watering places, in or near bedding areas, or where kills have been made.
- Set traps in quantity.
- Don't contaminate the area with human scent.

GATHERING

Plant species number beyond 300,000, of which a very small percentage are poisonous. Plants as a food source will be covered in detail in a future article. Animals besides being food sources, may lead you to edible plants and caches of nuts. Don't overlook eggs or the kill of an animal. Again, be cautious; your last wish is to change from the tracker to the trackee.

Food procurement is explained in fuller detail in AFM 64-5, Survival-Training Edition. Also, don't overlook the AFM 64-15 carried in your parachute. It illustrates many of the techniques discussed above.

To a degree, our culture determines the foods we eat; to overcome our culinary prejudices and eat strange foods could prove difficult. Asking one to eat an earthworm or grub would probably yield a reaction of "no way." But in a survival or PW situation, eating is essential if one is going to survive. Men have become seriously ill and even died because they refused to eat strange foods; strange in the sense that they weren't in their normal diet. Remember, you must make a mental adjustment and eat any and all foods, especially in a PW situation. ★

the second time around



MAJOR JACK SPEY
475 ABW

"This is Homedrome information India, time 02:45 Zulu, special observation. Sky condition: indefinite ceiling, 500 feet obscured, one mile visibility—fog. Temperature 68, dew point 68; wind 090 at 5 knots, altimeter 29.94. Expect VOR approach Runway 12; departure Runway 12. PAR and ASR out of service. Inform Homedrome Approach Control or Tower on initial contact that you have received information India."

Major Pete Simmons and Captain Jim Warren had flown the weekly courier run together many times over the past two years. Both were familiar with the route and had averaged 40 hours per month since being assigned to Flight Operations. Both were instructor pilots in the T-39 and very proficient on the gauges. Both had flown many low visibility radar and ILS approaches up and down the east coast.

Major Simmons called for the descent check list prior to the hand-off from Center to Approach Control, and the VOR approach to Runway 12 was briefed. The weather was close to minimums; however, both pilots had flown together fre-

quently and were very familiar with the airport, so neither had questions during the approach briefing or needed further elaboration on crew coordination procedures during the approach.

"Homedrome Approach Control, this is Bellcrank 40 out of niner thousand for four thousand. We have information India."

"Bellcrank 40, Homedrome Approach Control. Roger. Reduce air speed to 170 knots, if feasible. Radar contact 35 miles NE of the airport."

"Bellcrank 40. Wilco. Request radar vectors to the VOR final approach course."

"Bellcrank 40, Homedrome Approach Control. Roger. Expect radar vectors to the VOR final approach. Expect lower altitude in six miles."

"Bellcrank 40. Roger."

Approach Control provided vectors to the final approach radial, and descent was made to 1300 feet MSL prior to the VOR (FAF). Time to the missed approach point was 2 minutes at 120 knots. Major Simmons hacked the clock at station passage and a 600 foot per minute descent was initiated. MDA was reached at one minute 10 seconds after station passage and level off completed at MDA.

"Start watching for the field, Jim."

"Roger."

"One minute thirty, Jim. You have the runway in sight?" Pause . . .

"Runway in sight just off to the left. Go visual!"

Major Simmons went off instruments and started a shallow left turn to get on runway center line. Power was reduced to establish a descent. As the pilot started the flare. Jim saw the 5000 feet remaining marker flash by and noted the speed at 110 knots. Instantly realizing that the Saberliner was going to fast to stop in less than 5000 feet, he warned: "We're long, Pete; less than 5 remaining! I advise a go from here."



"OK! Let's go-around. The boards are coming up."

"Roger."

"Go-around check list."

After the aborted landing and established on the instrument climb, the copilot called the Tower: "Homedrome Tower, this is Bellcrank 40. We're on the go for missed approach—ah—advise Approach Control we'll need vectors for another approach."

"Bellcrank 40. Roger—ah—stand by for a frequency."

"Bellcrank 40, maintain runway heading. Climb to three thousand and contact Approach Control on 363.8. Are you experiencing any difficulty?"

"Bellcrank 40, negative. We were too hot on that approach. We're airborne, climbing to 3000, going to Approach Control."

A non-precision approach, as such, has a number of problems associated with it when weather is close to minimums. Let's examine a few.

It is desirable for the pilot to descend to and level off at MDA prior to the MAP so that the MDA is not exceeded prior to sighting of the runway environment sufficient to effect a safe landing. This means descent must be initiated again once visual clues are adequate for a landing. If the visibility is low and/or close to minimums, the approach may be excessively steep in relation to the first one-third of the runway, the touchdown area. After the approach descent is then reestablished, touchdown may occur well down the runway with stopping distance available becoming a critical factor.

When visibility is minimal, be mentally prepared for an aborted approach. Late sighting of the run-

the second time around

continued

way may prevent an approach from being made with sufficient runway remaining to stop the aircraft.

During a non-precision approach, do not expect to be on runway center line unless you are flying a localizer only approach. VOR, ADF, and TACAN are designed to get you "in the ball park" but not necessarily in perfect alignment with the runway, especially when tracking from the navigation facility to the airport.

During the above approach to Homedrome AFB, the copilot was concentrating his vision off the nose of the aircraft while looking for the field. What he did not take into consideration was the fact that the pilot was tracking into a left crosswind and was slightly to the right of the on course as the MAP approached. Jim was not looking far enough to the left of the nose of the aircraft, having assumed the aircraft was on course.

As the MAP is approached, it is important to check the CDI and note the aircraft position relative to "on course." Note also the drift correction or intercept angle. A quick analysis will give a clue as to the direction to look for the airport or runway environment. It may not be straight ahead and seldom is. The surface winds given by ATIS, Approach Control or Tower will give an important clue as to the correction needed on final approach, and this combined with aircraft position relative to the CDI will help in looking for the airport in the proper direction.

Jim expected that the first visual clue of Runway 12 would be the sequential strobes of the 3000 foot long approach lighting. After the missed approach, while on downwind, examination of the airport diagram at the bottom of the letdown plate revealed that Runway 12 has an A3 lighing system and no strobes. Being accustomed to landing on Runway 30, the primary instrument runway and most often used due to winds, the crew assumed strobes were available. The lesser effective approach lighting system added to the delayed runway sighting.

Speed was also a factor in this case. The aircraft weight permitted the final approach to be flown at 105 knots. 120 knots was used since the approach plate gave the exact time to the MAP for a 120 knot final.

During a non-precision approach, the slower the ground speed the more time the pilot has to see and react to the runway visual clues during transition to visual conditions. If the aircraft performance and command directives permit some latitude in final approach speeds, consider using the lower speed to give yourself a few added seconds for runway acquisition and transition to visual conditions.

During the approach to Homedrome AFB, as briefed, Jim had momentarily turned on the landing lights close to the MAP. The glare, resulting from reflection off the fog and mist, masked the contrast produced by the lights from the ground and runway against the black of the unlighted terrain. This may have contributed to the delay in recognition of the runway environment. Moisture on the windscreen also refracted the light, further hindering forward visibility.

Consideration should be given to delaying use of landing lights until such time as it will not obscure forward vision. Use of windshield wiper systems may improve forward vision when descending through dense clouds, fog or mist.

Bellcrank 40 landed safely out of the second approach. During vectors to the final approach course the second time, the crew formulated a *better picture* of the problem in terms of runway lighting, weather, and anticipated slant range visibility. Captain Warren noted the aircraft's position relative to the CDI as he started his search for the airport lighting. A slower final approach speed was used from the VOR inbound. Landing lights and scan lights were left off until over the threshold thus preserving night vision.

In the crew bus driving to Ops, Pete and Jim discussed the two approaches and concluded that sometimes things go better the second time around. ★



CONTROL & SUPERVISION and FLYING

COLONEL PAUL M. DAVIS
24th Composite Wing

No aircraft accident, however clear-cut the ultimate cause and blame, is due to a single failure or failing. Many interrelated factors form a chain which leads to tht final event. But one factor that is almost always present is inadequate control or supervision of some aspect of the flight. Therefore, it will do no harm to remind ourselves of what we mean by "Control & Supervision of Flying" and of the responsibilities in this arena which authority carries.

WHAT IS IT?

What do we mean by the words "control and supervision?" By control we mean to direct and regulate. By supervision we mean to oversee, to watch over imaginatively and intelligently. The two are thus complimentary and are an essential part of the vocabulary of all who are engaged in flying. For not only must those in authority control and supervise their subordinates but we must all, individually, control and supervise, regulate and watch our own actions.

Let's look at this more closely. Supervision is the means by which we ensure that all those under our command carry out their duties cor-

SUPERVISION

continued



rectly and efficiently; but we must supervise in such a manner as not to appear to interfere unduly; not to get so immersed in the detail of the task as to deny the proper responsibility of those who have delegated powers.

Everyone needs supervision—the pilot new to the squadron, the experienced operations officer, even the squadron commander and those above him. Some people are lucky enough to be able to supervise without much conscious effort, but the majority of us must work hard to acquire the skill. The degree of skill which an individual attains will depend to a large extent on the help and supervision he himself has received in the past.

Most aspects of our tasks are governed by orders, regulations, standard procedures and other instructions. We hope they are all clear and concise because orders and the like are there to be complied with for specific reasons, not because of arbitrary whims on the part of some supervisor. Some people in immediate authority seem to think that the mere existence of an order exonerates them from ensuring that it is complied with. These people are often heard to cry, generally after an accident, "we have a regulation against that and he (he being the unfortunate pilot or aircrew member) signed it and I have his initials to prove it." This is not leadership, nor is it proper control and supervision of flying.

Unless we are sure that an order has been carried out, how can we be sure that our subsequent actions are based on proper foundations? Some people think, too, that to comply with the letter of the law is sufficient. But there is more, much more, to it than that. Consider a simple training mission. First, the task is laid on, the participants selected and briefed, the flight plan is computed, the flight is authorized, flown, and finally the crew is debriefed. All of this is very straightforward, but all too often the task selected is the yet unfilled sequence on the training chart. The briefing makes liberal use of such glib phrases as "line-up and take-off will be standard. Any questions?" There being none, authorization consists simply of a signature on a clearance, and the debrief a casual check that the mission was accomplished and another signature on a hastily prepared grade slip for the flight records.

But, did the authorizing authority know the capabilities of the crews involved? The limitations? Was he aware of their strengths and weaknesses *before* the flight? Did he relate the task to the weather, satisfy himself that the crew fully understood the rules, check the flight plan and ensure—by a thorough debrief—that lessons were learned from all aspects of the flight? Such consideration of the factors involved in every flight is by no means automatic and many serious accidents testify to the fact that no small number of officers in positions of trust and responsibility did not consider these things.

HOW IS IT OBTAINED?

Often, investigations reveal that past failings have been condoned or followed by no more than gentle wrist slaps when it was obvious that more severe disciplinary action should have been taken. Each case, of course, is different and must be treated on its merits. The degree of remedial and corrective action required will, in general, depend on the seriousness of the failure. What good to detect a failure if nothing is done about it; it is pointless to make orders and then fail to enforce them. How often has a minimum altitude for, say, an aerial demonstration or flyby, been laid down only to be contemptuously ignored? Either severe disciplinary action should have followed the failure to comply with the order, or the order should have been changed —prior to the flight.

The authority to order a flight carries with it an absolute responsibility to supervise. The need for

those who authorize flights to consider the flying experience, capabilities and qualifications of the aircrew can never be taken lightly. Whether the flight is to be advanced training by an exceptional pilot or a simple training exercise by an inexperienced student, the person ordering that flight must be certain that the task to be performed is not beyond the capability of the individual involved. If it is clear from the evidence of an accident investigation that an individual was being extended beyond his limits, how much sooner should this fact have been spotted—and remedied—by his supervisor?

A particularly vulnerable phase in a pilot's career comes in the early stages of his first squadron tour when he is being trained to become a productive operational pilot. Individuals, even of apparent equal ability, progress at different rates; inexperienced pilots generally do not admit to their limitations, even if they know them, and some will have had difficulty making the grade or will have exhibited potentially dangerous traits in their first months in the squadron. Crews need very close supervision if their self-confidence and skills are to be developed without at the same time overtaxing their ability and confirming bad habits. It is tragic that this care and protection all too frequently are found missing.



WHO NEEDS IT?

An all encompassing answer might be "who doesn't?" That, however, is oversimplification. Inexperienced or below average pilots are not the only ones in need of supervision. Many accidents due to gross breaches of flying discipline such as low level "buzz jobs" or "shining the fanny" types involve pilots of acknowledged ability and skill who are occasionally in supervisory positions themselves. Information on the motives for this sort of behavior is limited because not many survive the accident. Nevertheless, the resulting investigation all too frequently turns up evidence which indicates a lack of essential supervision.

An oft repeated remark is to the effect that the pilot or crew concerned were normally beyond reproach and that their lapse was completely out of character and, therefore, inexplicable. Investigation, however, often presents an entirely different picture of the people involved, much more in keeping with the final result. Quite clearly the accident was not out of character at all. Those responsible for supervision and control simply did not know the real character of the people involved, or even worse, chose to ignore known failings.

Bad habits, long standing personal antagonism and past blatant disregard of orders and regulations all too often come to light only when it is too late. Pilots and crews are not Jekylls and Hydes who change their personality as soon as they step into an aircraft. They are quite normal human beings whose behavior is fairly predictable once their basic personality and character is recognized. To supervise effectively we must know those who work for us. The close contacts of our profession enable us to observe our subordinates much more closely than our civilian counterparts can and thus we have a better opportunity to understand their motives and actions.

WHY IS IT ESSENTIAL?

The United States Air Force needs men of character, of spirit and initiative. But we also need them to be skillful, thoughtful and responsible. We cannot afford the brash young, or old, loner. There simply is no place for him. The young and inexperienced need the help, guidance and influence of the older and the more experienced. To check and restrain, to direct, guide and oversee demands that those in authority understand and know the men and women for whom they are responsible. This, simply put perhaps, is the solution to our problem. It is not an easy solution; indeed it is most difficult and is common to all supervisors at all levels of management and in all professions.



But skill in it *must be acquired*. For unless we continually study our subordinates and strive always to know them better, we will not know their capabilities, their strengths and their weaknesses. And without this knowledge how can be hope to properly and responsibly "Control and Supervise Flying?" ★

OPS TOPICS

OPEN POD

The F-4 crew was on a cross-country flight. The crew had checked the baggage pod access door prior to engine start for the first leg and during the through flight checks at the refueling stop. However, after landing at home they found the pod door open and the contents of the pod gone. It seems that the access fasteners on the door can be positioned so that they appear fully closed but are not really locked. Subsequently the vibration and air loads inflight can cause the fasteners to unlock and allow the door to open. The unit involved in this mishap has modified its pods with alignment marks on the fasteners and heavy bags inside the pod to secure loose items. Even with these precautions it's a good idea to check those access fasteners carefully. It might save you from having to buy a whole new set of traveling clothes and gear.

NEW TCA PROCEDURE

Effective 30 April 1976, the FAA established the requirement for arrival and departure procedures to be contained within the limits of a TCA. This procedure applies to all heavy aircraft (above 12,500 pounds certified takeoff weight). Aircrews operating into a TCA can expect stairstep letdowns to remain above the floor of the TCA airspace. The result of the FAA order is that IFR flights will not be operating in or through the airspace below the TCA where VFR traffic is concentrated.

HATR

By now, aircrews and air traffic controllers should be familiar with AFR 127-3, 11 Jun 1976 and the new report, AF Form 651. Air traffic matters and near midair collisions (NMAC) were taken out of AFR 127-6 and should now be filed as a Hazardous Air Traffic Report (HATR). The report is much more detailed than the AF Form 457. We'd like for you to look it over so you will know the kind of information we need when the time comes to file. A few things to remember:

1. We want to know about *all* NMACs.
2. Do not file a NASA Aviation Safety Report (NASA Form 277) when an HATR is filed. The reg takes care of the NASA input.
3. Whenever possible, you aircrews should make an airborne report that you intend to file a HATR for an NMAC. The investigation wheels can then get rolling.
4. Don't delay notification to the handiest USAF safety office or base operations office after landing. You can even fill in the AF Form 651 blanks over the telephone. The flight safety guys will take it from there.

GROUND AIRSTART

An F-105 engine flamed out on the ground approximately 30 seconds after reaching idle rpm. The pilot used an airstart procedure in an attempt to restart the engine. A large fuel vapor cloud enveloped the aircraft with the ignition cycle in progress. The potential for a serious mishap is obvious. TO 1F-105D-1 does not address the consequences of attempting an airstart on the ground.

I would draw your attention to page ii and quote a couple of statements which should be kept in mind. "Your flying experience is recognized; therefore, basic flight principles are avoided." "Unusual operations or configurations such as asymmetrical loading are prohibited unless specifically covered herein." 'Nuf said?—Lt Col Jim Learmonth, AFISC/SEF.

OPS TOPICS

OPEN CANOPY

The OV-10 had been used on a previous sortie to familiarize an allied officer with FAC tactics. The officer had been briefed on egress and cockpit systems and procedures by the OV-10 pilot and life support personnel. After the flight the passenger deplaned and the OV-10 departed for home station. Approximately 10 minutes after takeoff, the left rear canopy came open. This canopy is not normally used and the latching handle can be placed in such a position that while it appears secure the over center mechanism is not engaged and the canopy will open. Apparently the passenger opened the left canopy during taxi and did not close it securely. The pilot, who had securely closed the canopy before the previous sortie, had no reason to suspect the status of the canopy was changed. (The handle looked secure on preflight.) It was only after the vibrations in flight moved the handle that the canopy came open. The moral of the story is: (1) Be sure your passenger understands what not to touch (unless you okay it) (2) Always check carefully after unqualified people have been in the aircraft.

THAT'S WHY WE WRITE IT UP!

A T-39 recently experienced a turbine blade failure as a result of an overtemperature. The investigation of this mishap indicated that a previous overtemp (3 days earlier) may have contributed to the failure. The only reason the earlier overtemp is known is that the crew wrote it up. There were no procedural deficiencies on the part of any person in either mishap. This merely serves as an example of the value of fully and accurately completing the 781.

STOWED OR NOT

We have been dropping equipment out of airplanes intentionally for years. But we also drop things unintentionally. In particular, we have had several incidents where equipment was not properly stowed in cargo compartments before cargo doors were opened.

FALSE START

The B-52 crew was engaged in an alert aircraft changeover. The copilot was removing personal items from the storage bin beside his seat. He moved the oxygen hose and as he released it, it snapped up against the copilot's side panel contacting the engine start selector switch. The force of the blow from the hose moved the selector switch and fired the cartridges on engines 4 and 6. This is the second mishap recently in which careless movements of personal equipment were directly involved. Most cockpits don't have much extra room, so be very careful when moving around.

HABIT INTERFERENCE

The pilot was making his first solo flight in an aero club T-34. Everything was fine until after he advanced power for takeoff during a stop and go landing. At this point the gear began to retract. The aircraft slid to a stop on the runway and the pilot exited unhurt. The pilot had never soloed a retractable gear aircraft before. All his previous experence had been in aircraft where the flap switch was on the forward instrument panel. Apparently during the takeoff sequence he mistakenly retracted the gear as a result of an old habit pattern.

OPS TOPICS

FO (KNOB)

During an ACM mission the pilot in the rear seat of an F-4 initiated a right turning defensive maneuver. When he tried to recover from the turn he could not move the stick left of neutral. The instructor, in the front seat, took control and recovered by completing the roll through inverted to wings level. After a controllability check the IP found that he had sufficient control to make a successful landing. The investigation uncovered a plastic knob, similar to that used on the pilot's flight instrument light rheostat, jammed between the left lateral control spring cartridge and a bulkhead in the left SLR compartment. This knob did not come from the cockpit. It is probable that the knob had in fact been present in the compartment since manufacture. Although this is an unusual incident, it illustrates the hazardous potential of foreign objects. If you lose something in a cockpit, write it up! You might have to fly that airplane again.

COVERING THE COVERS

When the UH-1N was preflighted, the crew did not notice the inlet covers laying unsecured under a seat in the left alcove. (There was a briefcase blocking the view of the covers.) Later as the Huey was flying to the aux field the crew saw both covers fall out of the aircraft. The unit involved no longer carries inlet covers (secured or not) on local flights.

DON'T LET IT SINK IN

As the F-15 Eagle crossed the runway threshold the pilot pulled the throttles to idle. When a sink rate began to develop, the pilot reacted by increasing pitch instead of power. As a result, the aircraft fuselage tail fairings and AB external nozzle segments were dragged on touchdown. As an additional note, the pilot had not flown for 29 days prior to the mishap. When your proficiency is down it pays to be a bit more careful.

THAT "SINKING FEELING" AGAIN

Two more fighter pilots have experienced that sinking sensation common to steep, low power approaches. Like the Eagle pilot in the mishap above, these two cases involved pitch angles so high that the tailpipes of one and the tail hook boattail and engine shroud of the other scraped on the runway. In both cases the pilots flew into a low airspeed high sink rate condition and recognized it too late for corrective action. Also like the Eagle mishap, there were special circumstances. In one case the pilot was an inexperienced student and in the other the approach was at night.

STATIC ELECTRICITY INFO

Information concerning incidents that have occurred as a result of electrostatic discharges is needed by the Air Force Electrical/Static Hazards Team (SA-ALC/SFQH) for research and historical background.

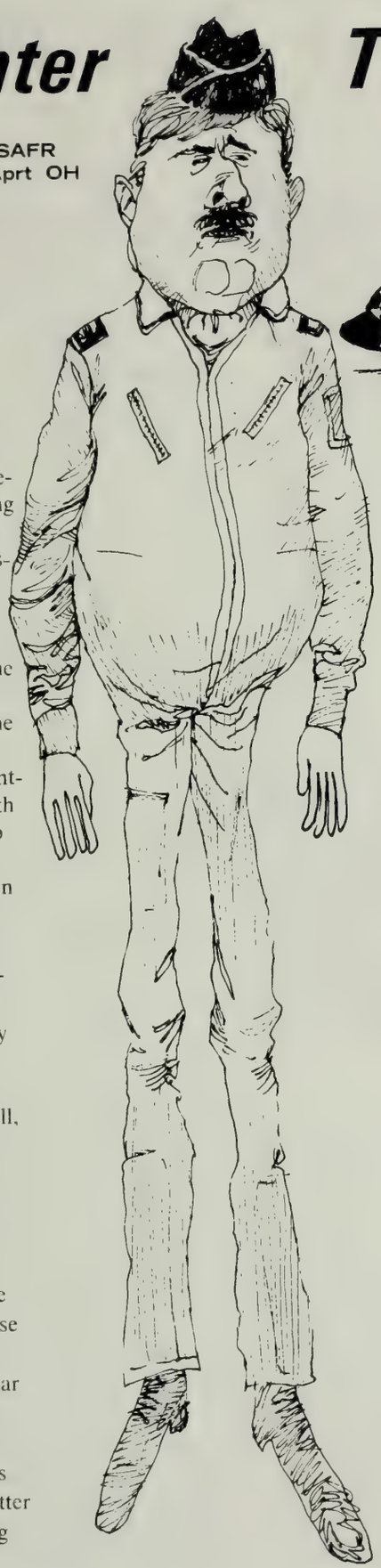
Mishap information should contain accident/incident report number, if reportable. If not reportable, a factual narrative, date, place, organization, weather, clothing worn, and agency/equipment involved.

Information should be forwarded to the Air Force Inspection and Safety Center (AFISC/SEG), Ground Safety Division, Norton AFB, California 92409, Attn Captain Countryman. ★

From Fighter To Airlift

MAJOR P. K. WOOD, MC, USAFR
179 TFG • Mansfield Lahm Aprt OH







In late 1975, the 179th Tactical Fighter Group, Mansfield, Ohio Air National Guard, began to receive rumors that the unit was being considered for a major change of mission. We listened with smug disbelief that our bold fighter jocks, dog-fighting in sleek, single seat, supersonic rockets with wings, would soon be driving multi-engine prop-type transports. No way, we said, can the Guard shoot down the best damn fighter outfit in the nation, with an eight-year, accident-free record of flight operation, with a first lieutenant being named Top Gun in the Ohio Air National Guard Turkey Shoot, three years in a row, despite getting married and fathering a new baby. No way, we said, can they renig on their promise to trade the old F-100's for the new A-7's being delivered to many Guard Fighter Squadrons.

No way, we said, would our stall, spin, crash, burn and die, drink and love all night, fly three 8-G missions, with head swiveling the full 360 degrees on the shoulders, ever be a bus driver in the C-130. We yelled and screamed about the runways being too narrow for those trash haulers, high noise levels, FOD problems, inadequate hangar space, wasted tax dollars, morale deterioration, friends in congress, obvious reasons why this idea was preposterous. Certainly, with a letter to the right congressman, alluding to the fact, that our commanding officer can drink more than your commanding officer, the whole disaster plan would be averted.

But, slowly, the rumors began to change to reports, then to telephone calls, then visits to and from Guard Headquarters, then to messages, and finally directives. And, suddenly, the stark reality—delivery dates for the first C-130. Reluctantly, but inevitably, we began plans for "4 Flights of 4," the valiant F-100's, fading, to the boneyard.

The psychiatrist has studied and written extensively about the mind of the aviator, and even the progressive thinking Erica Jong in her book "The Fear of Flying," alludes to the psychologic slips and Freudian fantasies inherent in flying. The age-old concept of the airplane being a phallic symbol with wings, and the exhilaration of the G-Force replacing the orgasm, are so overplayed as to become boring. This flight surgeon, however, has heard with his own ears, a high ranking flight commander, goggles, leather jacket, scarf trailing, admit readily that lovemaking is first in his mind, when no plane engines are turning up. And having served a tour of duty as flight surgeon aboard the nuclear carrier Enterprise, I know the fighter pilots are the boldest, and bravest of all, as the Army Air Corps song so proudly hails. Each squadron



aboard the carrier has its own stereotype, personality, be it attack, heavy bomber, helicopter, reconnaissance, or mail carrier, each proud of its mission, but, never quite to match the image at happy hour, or in the air, of the "Thousand-Mile-An-Hour Club."

Now, admittedly, most flight surgeons are frustrated fighter pilots, and this author is no exception. Nothing thrills him more, with the possible exception of a beautiful girl, than assuming control of the stick; and with the security of 30,000 feet and $100,000 worth of training in the front seat he goes cavorting through the windswept heights, lazy 8's, split S's and his own version of the hammerhead stall when he doesn't apply enough back stick on his loop. He really knows deep down inside he could do it himself, but for the time being, he is happy to let his flying buddies make the take-offs and landings, the low level air-to-ground, and the wing-tip echelon in the soup. Not so with the true fighter doing open heart or brain surgery, he knows he can do it better.

In this writer's career he has come to realize that fighter pilots are some of the finest people in the world, but like doctors, they must be reminded once in a while, they cannot walk on water. There must be some mutual harassing, as well as some mutual respect to make aviation medicine meaningful. The old adage of the commanding officer of a powerful aircraft carrier being worried that some snot-nose lieutenant doctor will lose his shot card and ground him, makes only a good sea story for happy hour. The flight surgeon is really like a good bartender—hears all, tells nothing, and takes a hell of a lot of chances. Unless the pilot is missing an eye, or a leg, or running a 106 degree temp, he most likely can go flying, if his peers in ops will give him an airplane. Once the aviator knows the doc feels this way, he will come to see you when he doesn't feel the tiger in his bomb bay.

With all this fanfare 'twixt the doc and the daredevil, the author is left with high respect for the flying types, and many good hours of boondoggle stick time.

Now the bicentennial year is fully evident, and our mission is set. Having just returned from a one-way backseat ride in the faithful F-100 fighter to deliver the D model and bring the refurbished fighter back to retrain, the author saw the first C-130, sitting on the ramp, vacated by the super sabres.

And, you can be sure, our pilots will be ready, if not in heart, in determined mind. We will be the best damn MAC outfit in the land. And the flight surgeon is proud to be a part of the 179th. ★

mail call

Review of an F-111 accident, which occurred in 1974, indicates that indoctrination of air traffic control tower personnel which followed may be a good idea for all tower personnel. An article, with a title such as ["Traffic Control Panic or Routine"] and similar to the following, is recommended for *Aerospace Safety*.

"All tower personnel should be aware of a phenomenon that occurs if certain aircraft, e.g., the F-111, dump fuel while in afterburner. The dumping fuel is ignited by the afterburner and a long tongue of flame results behind the aircraft 30 to 40 feet and rather horrendous looking. This can and has given observers the impression that the aircraft is on fire, and conscientious tower personnel have erroneously advised pilots accordingly.

"In the case cited, the aircraft had encountered severe FOD on takeoff, resulting in an emergency engine shutdown, and fuel dumping, while still in burner on the good engine, to expedite recovery.

"If a pilot is advised at a critical time that he is on fire when he is not, [that] may be just enough extra to cause him to 'punch out' when actually by 'cool hand Luke' procedures he can adequately cope with the emergency. The pilot in the FOD accident referenced, although concerned with the 'on fire' transmission, 'cool handed' it and recovered the aircraft.

"Recommend that all tower personnel be briefed on the subject in the interest of precluding a panic situation. F-111 bases can even provide an afterburner/fuel dump demonstration. It's considered a safe procedure and is discussed in the F-111 Pilots' Handbook."

GEORGE E. KAMMERER
Aviation Safety Specialist
Sacramento Air Logistics Center
McClellan AFB CA

(Extract from a letter by Capt Wayne R. Sander, Aircraft Maintenance Division, HQ Twelfth Air Force, Bergstrom Air Force Base, Texas)

Gentlemen:

I take exception to the article entitled "Two Perceptions" in the May 1976 issue of *Aerospace Safety*. I'm sure that Major Sutton's intent in writing the article was to give the maintenance man an "attaboy," but I question his means of doing so and your judgement in printing it. First, let's consider the maintenance man who reads the article. If his primary job is on the flight line, chances are that he reads it in his flight shack or shop between jobs. Hopefully he is able to finish the article before he is called out on the next job . . . and hopefully he is able to infer that the major means maintenance people when he writes "The foregoing chain of events is stopped every day by people doing their job—really doing their job." The author clearly points out that there are "maintenance" booby traps and that "maintenance" tried to kill him, but when the "attaboy" comes in the last paragraph, we become "people." If the maintenance man didn't finish the article or didn't understand its intent (chances are he's not a college graduate), he has a bad taste in his mouth, right? Maybe he's even as hard headed as I am and has the bad taste even if he did understand it. Rest assured that very few will respond "Gee, someone realizes that the majority of us are doing a good job" . . . as the author intended.

Dear Sir,

Reference the excellent article on Aerodynamic Coupling in your May issue, I'd like to make one small plea for the English language "as she should be spoke." The singular of "vortices" is "vortex", according to my Webster's New Collegiate Dictionary, and not "vorticie" as shown in figures 2 and 3 on page 22.

Errors such as this one (and "waivered" as opposed to "waived", a pet peeve of mine) are common in the USAF jargon, but use in highly respected publications such as yours only tends to further engrave them in stone in our minds.

I'm not trying to be a bad guy or a nitpicker of simple typos, nor am I hoping for my name in print (actually I'd rather not) but I do feel that this is one area where you can help prevent the decline and fall of the English language.

Thanks again for all your efforts on behalf of spreading the word. We quote you often. I intend to use your "Two Perceptions" article from the same issue in our maintenance safety program.

Yours for better English,

PETER S. MINER, Captain, USAF
Chief, Quality Control
Edwards AFB, CA

ANSWERS TO IFC APPROACH QUESTIONS				
	1. b.	4. d.	7. e.	10. d.
	2. b.	5. d.	8. b.	11. d.
	3. d.	6. b.	9. b.	12. d.



PROPER FIT AND CONFIGURATION OF HELMETS

MAJOR WILLIAM D. HARRISON, Directorate of Aerospace Safety

Aircrew helmet loss rate during ejections has been running a steady 15 percent for some time. While this is an improvement from some of our earlier experience, we can do better with proper attention. Some hints to improve your chances of keeping your hat are:

- Helmet should be properly sized and individually fitted.
- Chin and nape straps should be fitted, and worn, snug against the chin and neck areas.
- Visor/s should be cut to form a light seal along the top of the oxygen mask.
- Visor/s should be worn down and locked at all times, if possible.
- Prior to ejection, time permitting, the chin strap and oxygen mask should be tightened further, and the visor/s should be lowered and locked.

These simple steps may save you from getting a few lumps on your head. ★

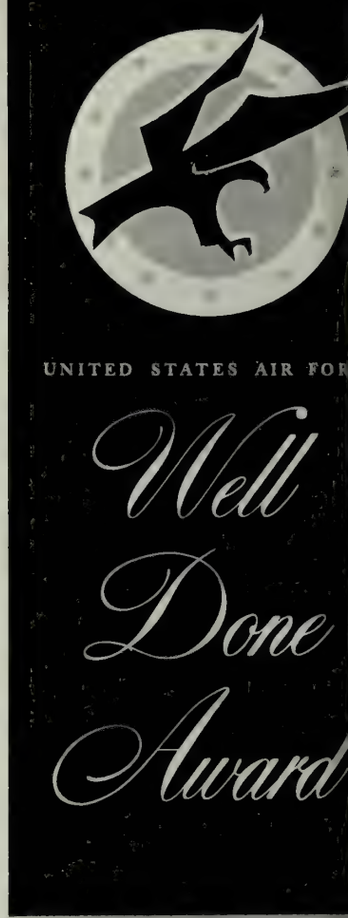
LET'S TIGHTEN OUR BELTS

A recent major aircraft accident investigation re-emphasized the need for properly adjusted restraint equipment.

The accident investigation board determined that due to an improperly secured lap belt, the pilot was displaced forward and to the right of his ejection seat during impact with an obstacle and the ground. *The improperly secured lap belt was not the cause of this fatal accident nor did it contribute to the fatalities, but the potential is there.* This mishap does point out the necessity to review the subject of restraints. You, the air crew, should be aware of how important it is to properly adjust lap belts and shoulder harnesses.

This subject should also be emphasized during life support continuation training.—*Mr. Rudolph Delgado, Directorate of Aerospace Safety.*

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Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



Captain MICHAEL E. DURBIN



Captain

RONALD D. SILKEY



Major

JOHN J. FRANCIS



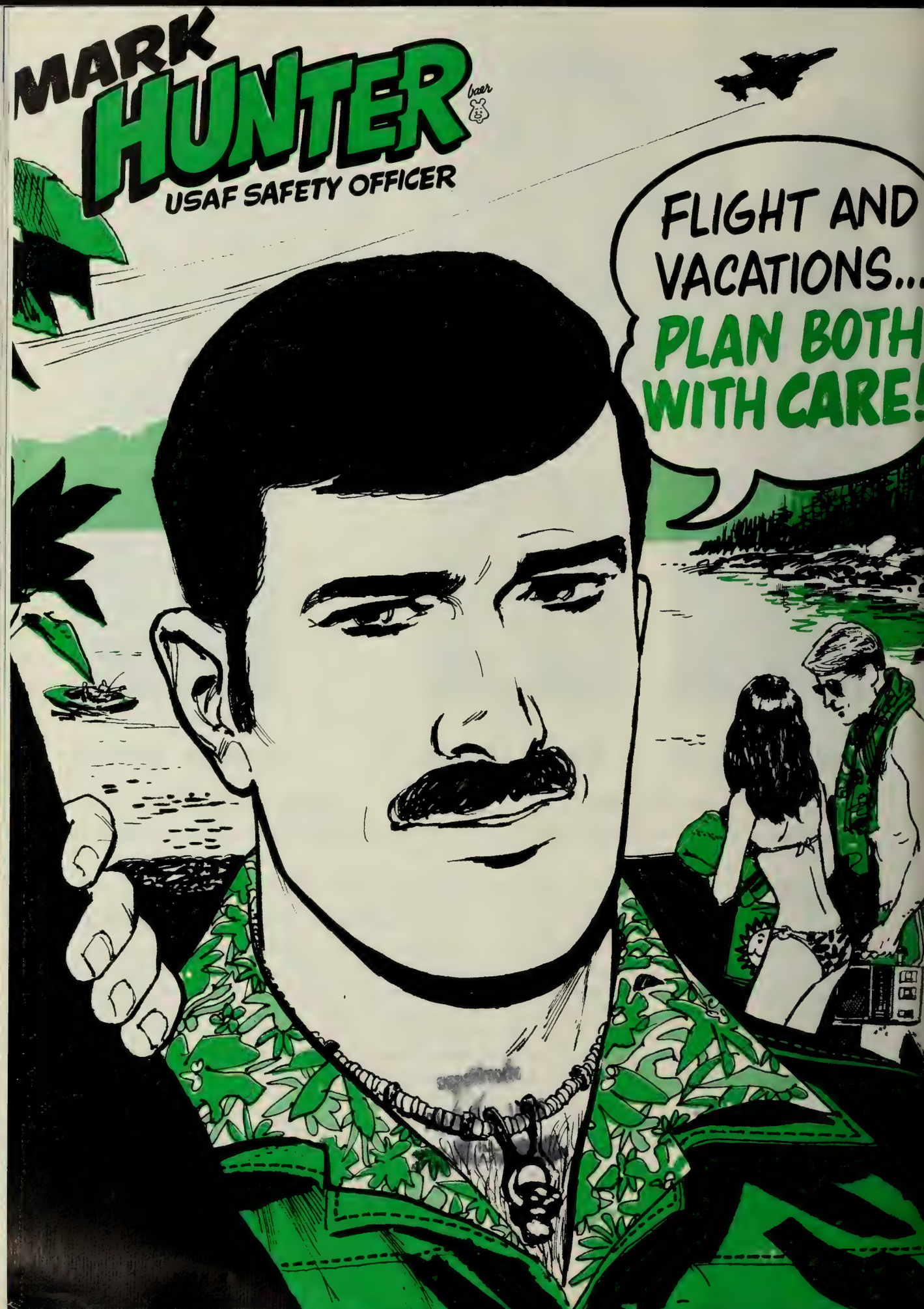
Major

JAMES H. THOMAS

3246th Test Wing
Eglin Air Force Base, Florida

Air Force Flight Test Center
Edwards Air Force Base, California

On 3 December 1975, Captain Durbin made a maximum power night takeoff in his F-15. The briefed mission quickly went by the wayside, however, when a safe gear up indication could not be obtained on takeoff. When Captain Durbin attempted to extend the landing gear, the right main gear still indicated unsafe. Captain Ronald Silkey, flying an F-4, visually determined that the right main gear was still in the wheel well. The problem was further compounded when the nose and left main gear could not be retracted. Activation of the emergency gear extension system and yawing and porpoising of the aircraft were to no avail. Captain Durbin was in continuous contact with Major James Thomas, an F-15 test pilot TDY to Eglin from Edwards AFB, California. Reviewing the alternatives, Captain Durbin chose to make the first approach and arrestment of the F-15, at night and with one gear up. Captain Durbin planned to fly the aircraft onto the runway, lower the nose wheel, and maintain wings level at 140 KIAS until crossing the barrier. Major Thomas notified the supervisor of flying, Major John Francis, who directed the foaming of the runway and the positioning of emergency vehicles. After several practice approaches, Captain Durbin landed his crippled aircraft and successfully engaged the barrier. Through teamwork, courage, and the exceptional professional knowledge and skill demonstrated by Captain Durbin, an irreplaceable aircraft was successfully recovered with minimal damage. WELL DONE! ★


MARK
HUNTER
USAF SAFETY OFFICER
baer
FLIGHT AND VACATIONS...
PLAN BOTH WITH CARE!

629.1305
FL4/5

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SAFETY SEPTEMBER 1976



THE APPROACH

The Critical 11 Minutes

Danger Area

Low Altitude Wind Shear

IFC Approach

UNITED STATES AIR FORCE SEPTEMBER 1976



Cover photo by
SSgt Steven Spoors
Det 5, 1369 PS (AAVS)
Elmendorf AFB AK

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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SEPTEMBER 1976 AFPR 127-2 VOLUME 32 NUMBER 9



Thunderstorm? Cumulonimbus?

MAJOR HERBERT WEIGL, JR.
All Weather Service • Scott AFB IL

Circle the correct answer.

T F Flight hazards associated with thunderstorms aren't associated with cumulonimbus.

T F Cumulonimbus (CB) are less intense than thunderstorms.

T F Some MAJCOM supplements to AFR 60-16, General Flight Rules, specify in-flight thunderstorm avoidance criteria. These criteria apply equally to cumulonimbus.

Finished the quiz? The answers are: false, false, and true. At least I hope the third answer is true because thunderstorms and cumulonimbus ARE THE SAME THING.

The **Glossary of Meteorology** defines thunderstorm as, ". . . a local storm invariably produced by cumulonimbus cloud, and always accompanied by lightning and thunder, usually with strong gusts of wind, heavy rain, and sometimes with hail." The same source defines cumulonimbus as, "A principle cloud type (cloud genus), exceptionally dense and vertically developed, occurring either as isolated clouds or as a line or wall of clouds with separated upper portions. . . . The usual occurrence of lightning and thunder within or from this cloud leads to its popular appellations: thundercloud, thunderhead, . . . , and thunderstorm."

Simply put, weather observers report thunderstorms when they hear thunder, whether or not they can actually see the associated cumulonimbus cloud(s). They report cumulonimbus, e.g., CB W - N (cumulonimbus west through north), when they see cumulonimbus clouds, but cannot hear thunder.

Aircrews should take the same precautions when briefed about thunderstorms. The hazards are the same: lightning, turbulence, wind shear, heavy rain, hail, etc. ★

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DOVER AFB	Dover, DE
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KI SAWYER AFB	Gwinn, MI
REESE AFB	Lubbock, TX
VANCE AFB	Enid, OK



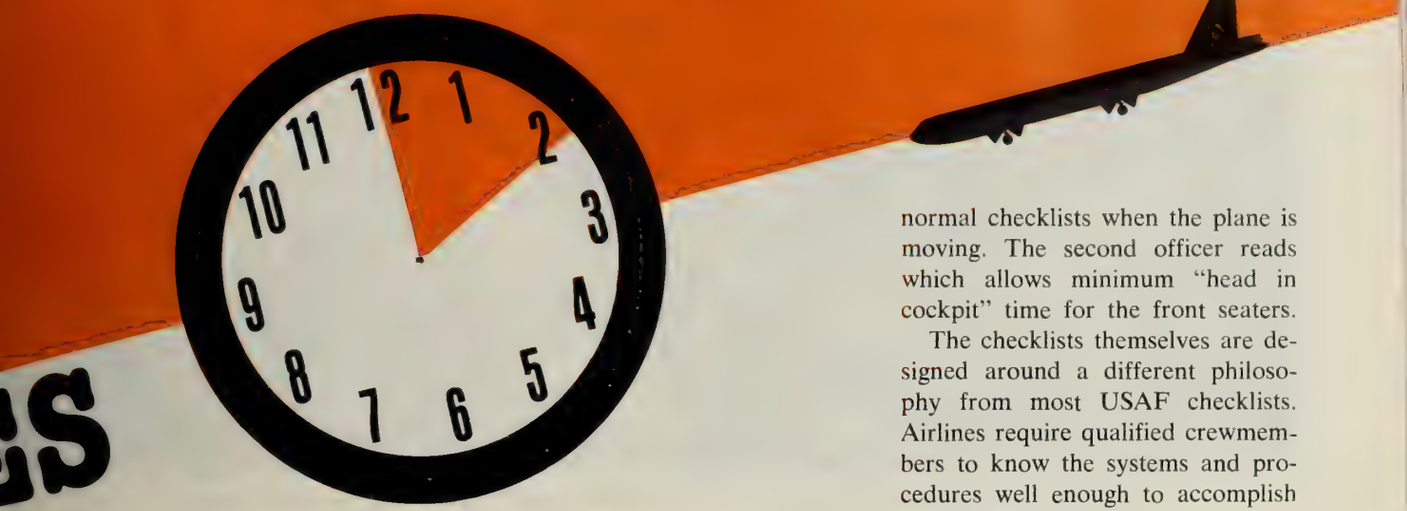
CRITICAL 11 MINUT

First published in SAC's **Combat Crew**, this article takes on the subject of pilot workload during the most critical period of flight. While the B-52 crew is featured, the problems presented apply in some degree to all crews—from the single seater to the many member crews, so we're reprinting it for all to ponder. Ed

A B-52 is approaching home base after a long mission practicing low level, bombing, refueling, and navigation. The crew is tired but satisfied with their performance today. They now start the series of tasks required to get the big hummer on the ground. The AC flies the airplane and calls for the descent checklist. They review the approach and the copilot calls metro for the latest weather. The AC monitors center, who turns them over to approach control, and he retunes the radio. The copilot finishes copying the weather and changes No. 2 UHF to command post where he confirms their intention to land and relays a list of maintenance writeups. The AC then calls for the continuation of the descent checklist (19 items) and they start the penetration. The most critical minutes of the mission have begun.

From penetration to after landing the pilots will read and accomplish 54 checklist items, numerous radio calls to approach, GCA, tower, possibly to their command post again, several crew coordination interphone calls, and fly the airplane. In a few words, they are busy as H--- and must fight to prevent additional distractions such as weather or possible emergency procedures from overloading the system and interfering with the primary task of safely flying the airplane. We all know flying the beast is number one but

MAJOR JOHN R. DOCKENDORFF • HQ SAC Offutt AFB NE



other things can get nearly out of control more often than we like to admit.

Contrast this with the airline crew who is making an enroute descent to the civilian airport on the other side of town. Wait a minute! Read just a little more before you turn the page.

I know the missions of these two crews are vastly different and that the Buf is more complicated, but I submit that all aircrews face very similar problems in those few minutes just after takeoff and just before landing.

Back to the airliner—the cockpit crew (normally three pilots) comes out ahead in this comparison with a SAC crew for several reasons. Some are logical, some are controversial, but since the airline safety record is better than ours, maybe we can learn something from them. After all, we in Safety believe there is no plagiarism in our business, so if somebody has a good idea we feel free to borrow it.

The first advantage the civilians have we can't do much about, most domestic crews get 30-50 takeoffs and landings per month. On the one hand this amount of practice is beneficial, but statistics can penalize airline crews by the sheer magnitude of their increased exposure to the critical minutes of takeoff and landing. To reduce the hazard of this exposure, one airline has a program we can learn a lot from. It is called "The Critical Eleven Minutes" of a flight.

The critical eleven minutes are defined as takeoff plus three and landing minus eight. The program stresses two concepts. One is individual crewmember awareness and readiness, to insure that they are prepared to take timely and appropriate action if an emergency occurs. This is stressed to the flight attendants in the form of a suggested "30 Second Review" of emergency procedures (evacuation, door and slide operation, etc.) to be done everytime they strap in for takeoff or landing.

The second concept is the development of procedures to minimize cockpit distraction and workload, especially during the critical eleven minutes. For example, the NO SMOKING sign is usually on during these eleven minutes and is designated as a signal to remind non-cockpit crewmembers not to knock, enter, or even call the cockpit on interphone while this sign is illuminated, except in serious emergency. Other cockpit procedures are also designed to minimize distractions.

Some airlines require that neither captain nor first officer read any normal checklists when the plane is moving. The second officer reads which allows minimum "head in cockpit" time for the front seaters.

The checklists themselves are designed around a different philosophy from most USAF checklists. Airlines require qualified crewmembers to know the systems and procedures well enough to accomplish them at the proper time, then read a brief list as a true doublecheck. This contrasts with USAF's "read and do" philosophy. Disregarding philosophy, one result is an airline checklist consisting of 15-25 items which accomplish the same basic functions as the aforementioned fifty-four B-52 items.

Checklists were further modified as a result of the critical eleven minutes program. The reading of After Takeoff Checklist is delayed until 10 to 12,000 feet is reached. Power and flap adjustments are made at the appropriate time, but delaying the reading maximizes the time available for all three pilots to watch for traffic and cross-check instruments. In the landing phase the preliminary checklists are done early (usually above 10,000 feet) such that only three to four items remain to be read when final approach is started and a three-item final check is made when the gear comes down for final descent. Anything that reduces distractive elements such as checklist reading, making flight log entries, and radio calls during the time the airplane is in the busiest part of the environment—the airport area—is worthy of attention.

Another airline uses a procedure that is controversial even among other airlines. On every approach they obtain the airport altimeter



The Air Force checklist is an important and time consuming task on each approach. The current B-52 checklists for the descent and landing contain 54 items.

correction factor from their company dispatch office. After careful cross-check by all three pilots, they then reset two of the three altimeters in the cockpit to read altitude above the runway. In effect, this means that every approach at every airport looks the same on the instruments—the two altimeters always read zero on the ground. This means that for a 100-foot decision height (DH) approach, the pilots can always count on seeing 100 feet on the altimeter when the decision must be made.

Sounds wild doesn't it? But consider this. That airline has not had a fatal accident in several years and probably has the world's best safety rate as of this time.

Airline crew coordination and training philosophy is similar to the Air Force's in that Air Force manuals contain words similar to the following airline manual excerpt.

"The emergency procedures in this handbook represent the best available facts about these subjects. Flight crews should follow these procedures as long as they fit the emergency. At any time they are not adequate or do not apply, the flight crew's best judgment should prevail. Safe altitude and airspeed should always be of primary concern."

Have we been emphasizing this enough? What about this excerpt from an airline normal procedures section?

"All cockpit crewmembers shall assist the captain in monitoring and cross-checking instruments, speeds, assigned altitudes and headings, control positions, including flaps, spoilers, landing gear, stabilizer position, etc. A crewmember shall immediately call to the captain's attention any discrepancy noted."

Do AF pilots properly and readily solicit this type of cross-checking by other crew members? We have the procedures but some crews appear to ignore them.

Why talk about the critical eleven minutes when we have always said safety must be "paramount" and be constantly stressed throughout the mission? Indeed, safety must be held constantly in highest priority, but history, luck, fate, complacency, pilot proficiency, crew discipline, or some as yet unnamed factor has so far proven that safety is like a blanket slightly too small to cover the bed. (We have not yet achieved a zero accident rate.) We must, therefore, cover those parts which are most vulnerable.

The world air carriers suffer about 85 percent of their airplane losses in the critical eleven minutes of flight. An analysis of SAC accidents since 1957 shows about 70 percent of the SAC major accidents also occurred in this time span. These numbers indicate the need to stretch a large portion of our blanket in this direction. Experience has shown that when we try to stretch the blanket in all directions at once —a' la "paramount"—thin spots and tears can occur. We must cover the most vulnerable areas pending the development of a better blanket.

What can you and I do? A good salesman would produce his order book at this point and ask for your order. The nebulous and intangible qualities of safety make this difficult but we must start somewhere. SAC Safety has asked the "schoolhouse" experts (CCTS, CEVG, CFIC) to evaluate the following questions for possible use by SAC crews and make any other ideas known. These same questions can be evaluated by other commands for their own use.

- Could some items on aircrew checklists normally accomplished during the critical eleven minutes be eliminated or relocated to less critical times such as above 10,000 feet?
- Could pilots delegate more checklist reading to other crewmembers during critical phases of flight?



In contrast to the B-52 crew on page 4, an airline crew normally has only 15-25 checklist items to do in the same descent and landing period.

• Should checklist philosophy and construction be revised such that amplification is contained only in the flight manual and a simplified list used as a true doublecheck on items accomplished as opposed to the "read and do" list?

• Can other pilot duties, such as flight log entries, fuel panel changes and radio calls be accomplished during less critical times?

• What can be done to bring other crewmembers "into the loop" to improve crew discipline and provide a true cross-check to reduce the risk to the aircraft?

Many of these questions are based on nonspecific and time honored concepts but any area is fair game for safety if accidents can be prevented. Talk it over at hangar flying sessions. Talk to your IPs and supervisors. At the very least, think about these concepts and develop an automatic reaction of increased vigilance and your own "30 Second Review" of the critical eleven minutes of a flight.

* * *

Since Major Dockendorff wrote his article, there have been some developments. He summarizes these very well in a letter to *Aerospace Safety* quoted below:

"SAC Combat Evaluation Group (CEVG) is actively involved in redesigning the checklists for SAC aircraft. The subject study has resulted in many inputs and suggestions from crews in the field. All inputs are forwarded to CEVG for their consideration. As of this date they are staffing a much simplified B-52 checklist through the laborious steps required for checklist revision. SAC Safety and CEVG are currently establishing suspense dates for inputs for flight manual reviews for the other SAC airplanes. We are hopeful that improved checklists which reduce the hazards of cockpit distraction will result.

"Another facet of this study addresses the distractions of air traffic radio calls, frequency changes, and transponder code changes. SAC Safety has opened communications with FAA in order to explore ways to minimize this type of distraction. The FAA is very interested in investigating these areas as evidenced by their work with the Special Air Safety Advisory Group (SASAG) and their recently published study. As further evidence of their interest, they are reprinting the 'Critical Eleven Minutes' article in their Air Traffic Controller's Journal.

"The problems addressed in the SAC article and study are applicable to and could improve safety for everyone who flies airplanes. We hope that USAF will take the lead and sponsor a study or a continuing working group at USAF or even DOD level. At the cost of aircraft accidents these days, the savings could be spectacular.

J. R. DOCKENDORFF, Major, USAF
Air National Guard Advisor
Directorate of Safety,
DCS/Operations"

ABOUT THE AUTHOR

Major John R. "Doc" Dockendorff is currently on a 4-year military leave of absence from Trans World Airlines. Assigned to HQ SAC as the Air National Guard Advisor to the Director of Safety, he is a liaison officer for the transfer of KC-135 aircraft to the Air Reserve Forces. In addition to being a pilot for TWA, Doc served as an instructor flight engineer and taught flight attendant (hostess) safety. He has accumulated over 5,000 hours of flying time and has been an aircraft commander in the B-52D and (ANG) KC-97L. He holds a B.S. in mechanical engineering from Iowa University and an M.B.A. from Auburn. ★





TRUST

CAPTAIN PHILIP M. McATEE
Directorate of Aerospace Safety

As a maintenance officer who is also a civilian pilot, I have always tried to view the operation from the point of view of both the operator and the maintainer. I'd like to pass on some things that I have observed which may cause trouble.

The first things that come to mind are the aircraft forms and the exceptional release (ER). Most commands have a requirement that the ER be signed by the maintenance officer or 9-level maintenance supervisor, at least for the first flight of the day. This assures that the maintenance supervisors are aware of all discrepancies in the forms and consider the aircraft safe for flight. Here is where the first problem comes in.

I used to go out to the aircraft and review the forms while the crew chief was pulling his preflight. Now, most crew chiefs like to have as few write-ups as possible in the 781A, so they transcribe as many delayed or deferred write-ups as they can to the 781K. The block on the 781K isn't very big, and these days there are usually quite a few discrepancies being delayed. So, in order not to have too many 781K's, the discrepancy write-up is shortened as much as possible. Now that's OK to a point, as long as it has been shortened in a way that leaves the nature of the problem still clear. But that assumes that the crew chief understood the write-up in the first place.

Remember, aircraft are getting more complex all the time and the average crew chief knows very little about systems used in an operational environment. This is particularly true in fighter aircraft in which the crew chief never flies. Also, this lack of understanding of the need for, or use of, many systems is not limited to the crew chief, but often includes others in the maintenance complex, including debriefing personnel who assign the symbols. They may not be aware of the importance or dangers connected with a problem in a system.

So now we have the potential to put a serious, not understood write-up on a red diagonal and then have a well meaning crew chief transcribe and shorten the write-up down to an insignificant few words. I have frequently seen write-ups that should ground the aircraft be shown as red diagonals because the person assigning the symbol didn't understand the significance of the discrepancy or the importance of the system. Because of my flying background I would often catch these and upgrade them *before* they got in the forms, but frequently these were not discovered until exceptional release time.

Now to be ready to sign the release, it usually took me about 10 minutes of reading and asking questions about the write-ups so I knew what was wrong and where it was located. Sometimes I had to make a phone call to find out what a unit did and how important the system or part was for a certain mission.

Yet, amazing as it seems to me, I have seen aircraft commanders come out, look quickly through the forms searching mainly for red X's, ask not one question, and go fly. Remember, like everyone else, maintenance officers or supervisors all have different backgrounds and levels of knowledge about any aircraft. Most are not experts by any means. Maintenance may have signed the ER, but *you* are the one who is going to fly the aircraft. Trust is most definitely needed between aircrew and ground crew. But trust is a two-way street. You, the aircrew, are the important link. Remember, that crew chief expects that you will look at the forms and know and catch anything that is wrong, especially things he doesn't understand. ★

water/glycol FIRE HAZARD

MR. DONALD GWYNNE
General Dynamics
Fort Worth Division

An aircraft electrical fire is just about guaranteed to get everyone's attention. One such fire led to rediscovery by the USAF and the aerospace industry of a weird chemical process first reported by NASA in 1968.

A loose F-111 water tank cap allowed several gallons of water/5% propylene glycol mixture to spill into the main gear well area. Several days later, during a ground check of avionic systems, fire broke out in the gear well. Electrical power was cut off, and the fire self-extinguished.

This was no ordinary "short." The circuit breaker of the affected armament system black box had not popped. The wires around the burned cannon plug showed signs of overheating only within a few inches of the fire area. When high current is the cause of overheating, wire insulation is typically damaged the entire affected length.

It was learned after intensive investigation that a water/glycol electrochemical reaction fire had occurred as a direct result of water/glycol contamination from the loose ECS cap. Note that such a solution is very slow to evaporate and the hazard is present days or even weeks after contamination occurs.



This is a typical example of the wiring damage resulting from a water/glycol fire.

The passage of direct current (DC) through a water/glycol solution from a positive (anode) terminal of silver, gold, or rhodium can lead to an intensely hot flame, liberating considerably more energy than supplied by the DC current source (current values of less than one ampere are typical).

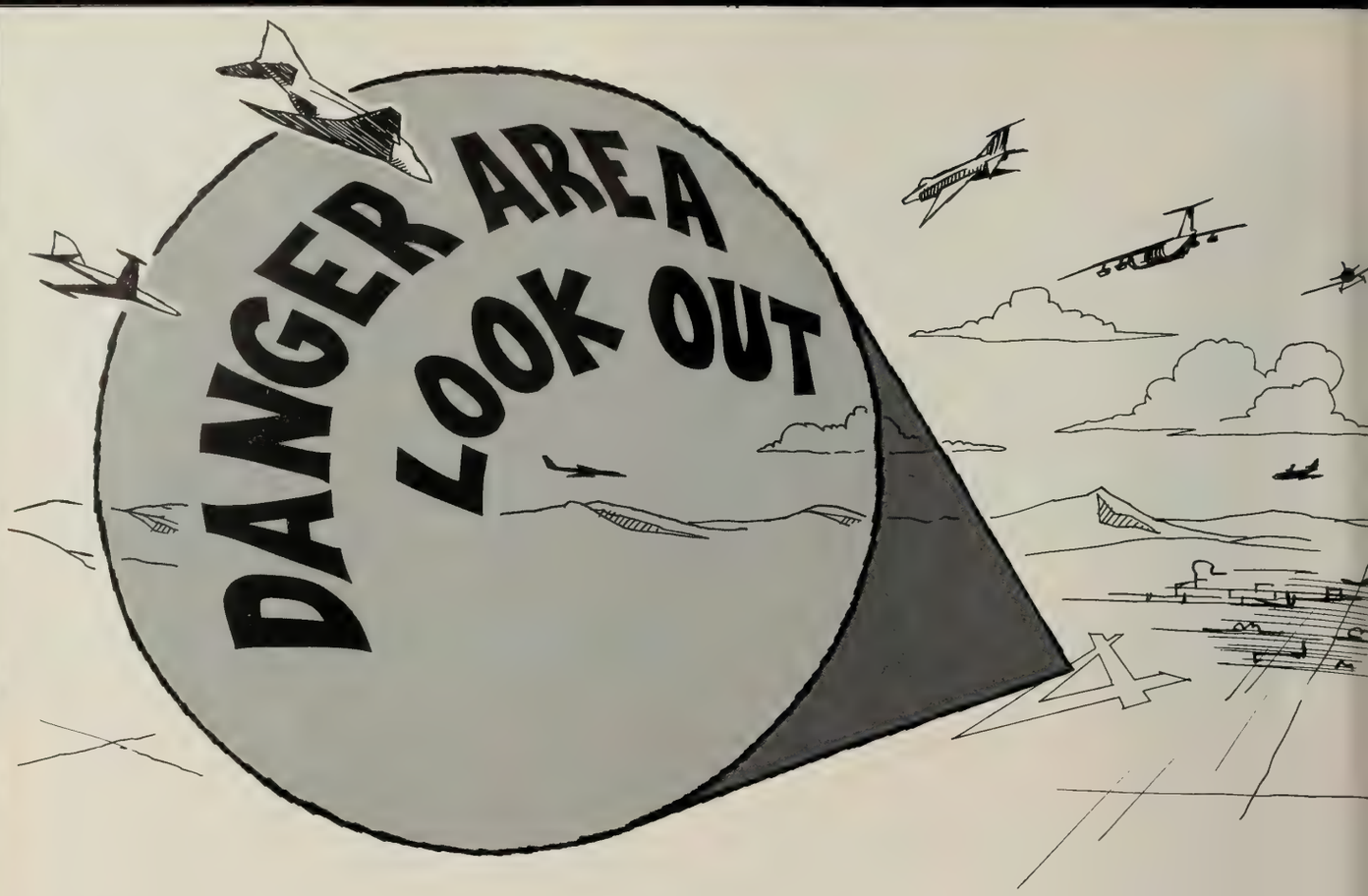
Since many aerospace electrical connectors, switches, relays, and wires use silver or gold plating, the USAF is a prime candidate for repeats of such fires.

Water/glycol solutions in common USAF usage include MIL-A-8243B Deicing Fluid, boiler water/5% propylene glycol solutions, ethylene glycol coolants, propylene glycol in air pressurization systems anti-icing, etc. Such solutions are also found in missile space systems such as Apollo.

After the previously mentioned mishap, another F-111 mishap pointed out a different danger. Fire occurred underneath the wing of an aircraft which had been recently deiced using MIL-A-8243. An underwing pylon disconnected socket was found burned. Normal ground service deicing operations expose electrical wiring, connectors and equipment to ethylene/propylene glycol solutions on a recurring basis.

Another loose F-111 water tank cap resulted in wetting of the circuit cards of an avionics black box, which subsequently led to fire within the unit.

Although no water/glycol fires have been reported from contamination of avionics via water in cooling air ducts, the possibility exists in some types of aircraft. Several cases of leaking gaskets have resulted in water/glycol solutions being introduced into the environmental cooling air ducts of F-111s, with resultant flooding of some avionic systems. In such instances, prompt decontamination action is required to prevent avionic equipment damage from corrosion and/or the water/glycol fire phenomenon.



MAJOR JACK SPEY
475 ABW

Most midair collisions occur below 5000 feet in VMC, and near the airport traffic area at maneuvering airspeeds. Few occur on airways at cruising speeds and altitudes. This is true, in part, because much of the traffic at cruise altitude is under air traffic control. Also, traffic becomes diffused at altitude and the probability of a midair collision decreases.

The *danger area* is that area between our cruising altitudes and the immediate airport traffic area: below 5000 feet, while maneuvering to and from the airport and while clear of clouds. It is in this "funnel" around an airport that traffic is most dense.

Before the gyro, the aviator was limited to flying by visual reference to the ground and sky. Aviation's capability took a quantum jump when the gyro was adapted to a reference instrument, and subsequent improvements now permit the aircraft to be flown during almost any weather. Along with the gyro instrument came the requirement for the pilot to be proficient in instrument flying. As with visual skills, this requires practice. Today we find ourselves practicing our instrument skills while both VMC and IMC. This has become necessary, in part, due to the tolerances required during evaluation flights; however, it has contributed to a condition where pilots, even when clear of clouds are devoting the majority of their cross-checks to *inside* the cockpit where danger cannot be seen.

Today as more pilots are placing heavier reliance on aircraft control by *instrument* reference, our ability to control the aircraft by *visual* reference is deteriorating. Given the condition of an increasingly crowded "danger area" and a reduction in outside cross-check by all pilots, the potential for a midair escalates. As the potential increases, our eyes remain the only reliable system for detection. It is, therefore, imperative that our outside cross-check be increased and our ability to fly our aircraft by natural reference be improved or maintained, while clear of clouds, particularly when maneuvering in the area of greatest danger.

Some may argue that you cannot fly a modern aircraft under visual conditions without heavy reliance on flight instruments. This is simply not true. A pilot who learned to rely on flight instruments, even in VMC, may experience more difficulty, but with practice he finds that flying an aircraft by reference to the "World's largest Attitude Indicator", the natural horizon and ground reference, actually works and works well.

The next time you are flying a transition mission in the VFR traffic pattern, cover the attitude indicator with a piece of cardboard and make a few trips around the flagpole by visual reference aided by altimeter and airspeed only. *This technique should only be tried in aircraft with more than one qualified pilot and then only if not prohibited by command regulation.* On base leg, improper pitch attitude may result in a higher speed and larger descent rate than desired, but following a few pitch changes relative to the "World's Largest Attitude Indicator", we will soon recognize the proper attitude to produce the desired speed. Altitude control on downwind leg may be a little erratic until we recognize the level flight attitude of our aircraft. During the experiment, there may be an enormous feeling of insecurity, but the IP or copilot can provide reassurances that all is not as bad as we might think. Following a few circuits, we soon realize that our aircraft can be flown with less reliance on flight instruments while in VMC conditions. In fact, with more practice she could be flown almost entirely by outside reference and flown well.

During an instrument arrival within the danger area, the pilot has two primary objectives: maintaining a heading assigned or predetermined by instrument reference, and maintaining a pitch/power relationship necessary to obtain the desired climb or descent rate and speed. Both these conditions can be maintained visually with a little practice. Five degree heading tolerance can be maintained by keeping the bird pointing toward a cloud or object on the ground, and pitch attitude necessary for desired speed can also be maintained by reference to the horizon or ground/sky juncture. Altitude reference, as always, requires occasional reference to the altimeter. Heading and airspeed maintained this way may not satisfy an evaluator's $\pm 2^{\circ}$ or ± 5kts criteria, but during the initial stages of an arrival, when VMC, these tolerances are not critical.



It is only during the *final* portion of an instrument approach that heading, altitude, and airspeed control become more critical, thus forcing the pilot to rely more heavily, if not entirely, on instrument reference in order to get "in the groove" and stay there. However, the transition to primary instrument reference should be gradual as the distance to the airport diminishes and the groove gets smaller.

During a departure from a busy airport under ATC control, modern instrumentation, the autopilot, and present day ATC radar actually make the pilot's job simpler. Today the pilot of modern equipment has more opportunity to concentrate his attention "outside the aircraft" when VMC, if he so chooses. Two degree heading variations are even less important when going out the funnel, but often will not be present thanks to heading select/nav auto pilots.

Make no mistake, we must continue to be the best possible pilots "on the gauges" when IMC or when it's 200 and ½, but we must also avoid the worst kind of failure—a midair!

Improvement of flying skills by visual reference to ground and horizon when in visual flight conditions is mandatory, if we are to safely transit the danger area and "see and avoid." Our eyes can detect the potential midair, which may not be seen if we are guiding our aircraft primarily by instrument reference. If we are to master the art of flying, we must strive to be an artist in both instrument and visual skills. Failure to master both is like the aspiring artist who is proficient in the use of one brush, and may invite the worst kind of failure. ★



Low Altitude Wind Shear

The effects of wind shear have been consistently identified by aircraft accident boards, civilian and military, as major factors contributing to accidents. The problem of wind shear is particularly serious because:

1. The pilot does not have reliable information as to its existence.

2. The effects are variable and unpredictable for any particular set of circumstances.

3. The pilot may not recognize the existence of wind shear until too late to take corrective action.

Wind shear is defined by the FAA/NWS publication *Aviation Weather* as "a change in wind speed and/or direction over a short distance." The most common example is the temperature inversion shear. This occurs when a warm mass of air moves over a cooler mass closer to the ground. This type of shear is especially dangerous because it often occurs at night when many visual flight references for landing are missing. Shear can also be caused by friction. That is, when there is a strong surface wind, the wind closest to the ground is moving slower than that at 25 or 50 feet because of friction. The other dangerous type of wind shear is that associated with thunderstorms.

How does shear affect an aircraft? An abrupt change in the relative wind causes an immediate change in indicated airspeed (IAS). However, the inertia of the aircraft prevents the ground speed (GS) from changing as rapidly. Thus, the change in IAS destabilizes the aircraft flight path and causes the pilot to make some adjustments in attitude or power. However, the aircraft inertia is soon overcome and GS moves to match IAS. This now requires pilot correction *opposite* the one just made. As an example, let's consider the situation in a recent accident. During an ILS approach, the wind shifted abruptly almost 180° at about 200 feet AGL. In addition, the speed changed from a 13-knot tail wind to a 5-knot head wind in 100 feet. This rapid increase in head wind component caused the IAS to increase and the aircraft's rate of descent to shallow. To correct to glide path, the pilot reduced thrust and increased the nose down attitude.

Then, as mentioned earlier, the ground speed reduced to match IAS. This meant that the power and pitch attitude were insufficient to maintain proper glide path. Thus, either the IAS must decrease, or the sink rate increase. In both cases, the result is a landing short of the ILS touchdown point. The aircraft contacted the approach lights 500 feet short of the runway threshold.

Shear was not the sole factor leading to the accident mentioned above. Several other factors all conspired to cause the short landing. However, a different type of shear has been directly responsible for two recent accidents, one Air Force and one air carrier. This is the violent, unpredictable and extremely danger-

ous shear associated with a thunderstorm.

The wind shear in a thunderstorm is usually related to the "gust front." There are several characteristics which mark this gust front.

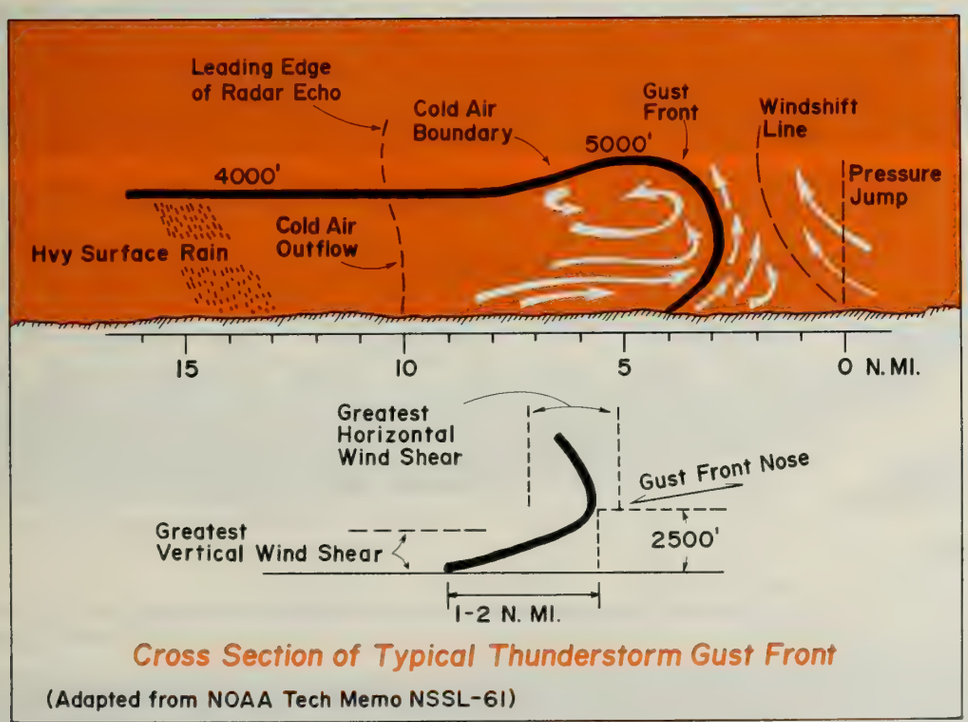
- It has high winds and gusts at the ground usually in the range of 40 to 50 knots.
- It moves faster than the thunderstorm which generates it. (It often precedes the leading edge of the thunderstorm radar echo by 5-10 miles.)
- The gust front above the surface may lead the surface position by a mile or two.

There have been horizontal wind shear speeds in excess of 40 knots measured across a gust front. Vertical shear has been reported in excess of 1800 feet per minute at 200 feet AGL in one storm. These violent downdrafts have been called "downbursts" by Dr. T. Theodore Fujita, Professor of Meteorology, at the University of Chicago in his research project into the meteorological phenomena associated with a civilian air crash at J. F. Kennedy Airport. This study contracted by Eastern Airlines led to the following conclusion: The sudden downdraft exceeding 1800 fpm was directly responsible for the high descent rate of the aircraft and subsequent crash. It is very possible that even if the flight crew had immediately recognized the high descent and made a correction, the winds may have been too severe for the correction to take effect before impact. This finding is also supported by the formal NTSB accident report.

Granted that wind shear is dangerous; what can an aircrew do to protect themselves? The problem is recognition. There is no really reliable way to predict shear, however, there are a few basic guidelines.

- The meteorological conditions which will usually generate wind shear can be forecast. Check your DD 175-1 and weather briefer for the details.
- Be alert for PIREPS. In the accident cited above, a preceding aircraft encountered strong downdrafts and reported it on missed approach.
- Be careful around thunderstorms, coastal airports or airports near mountain ranges. These are especially favorable spots for wind shear.
- The presence of surface fronts and inversions produce shear. The stronger the temperature contrast, the stronger the shear.

In essence, the best preparation an aircrew can make is to know that the possibility of a shear exists and if one is encountered, to act at once. ★

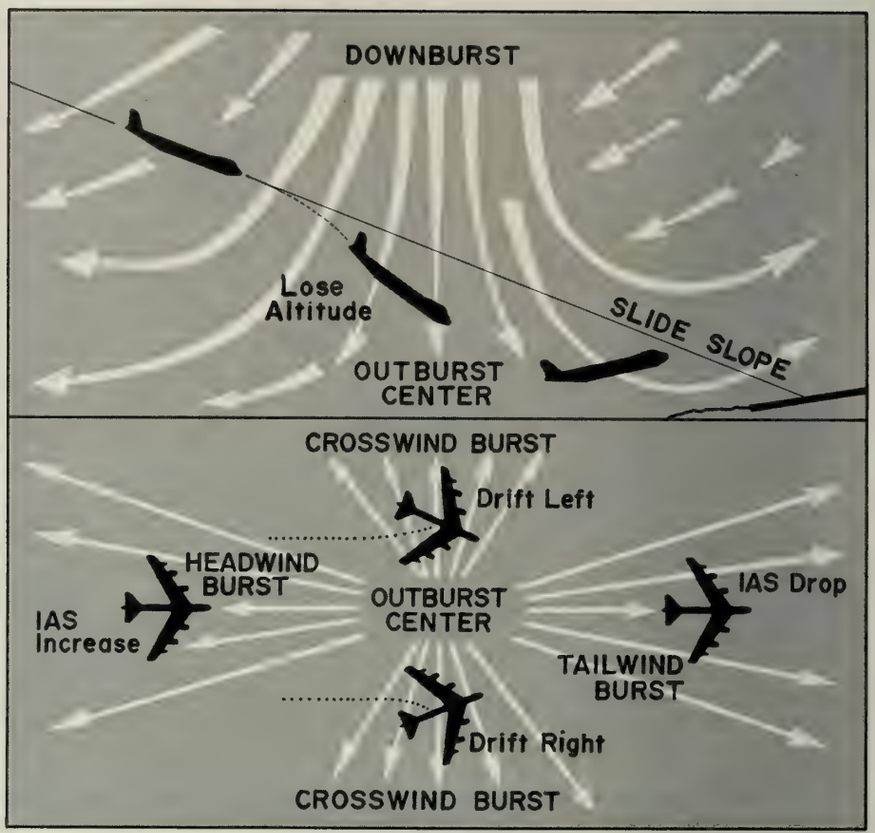


The approach of a thunderstorm gust front to an airport complex cannot usually be specifically detected until it has reached the weather instruments. At large airports the gust front may be affecting some approach corridors several minutes before the tower is aware of the condition.

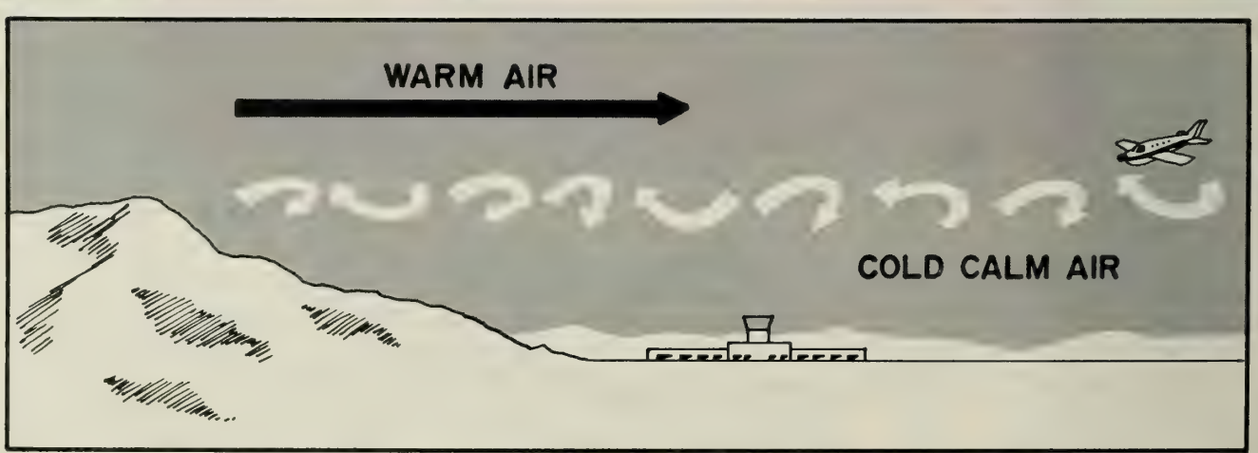
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Low Altitude Wind Shear

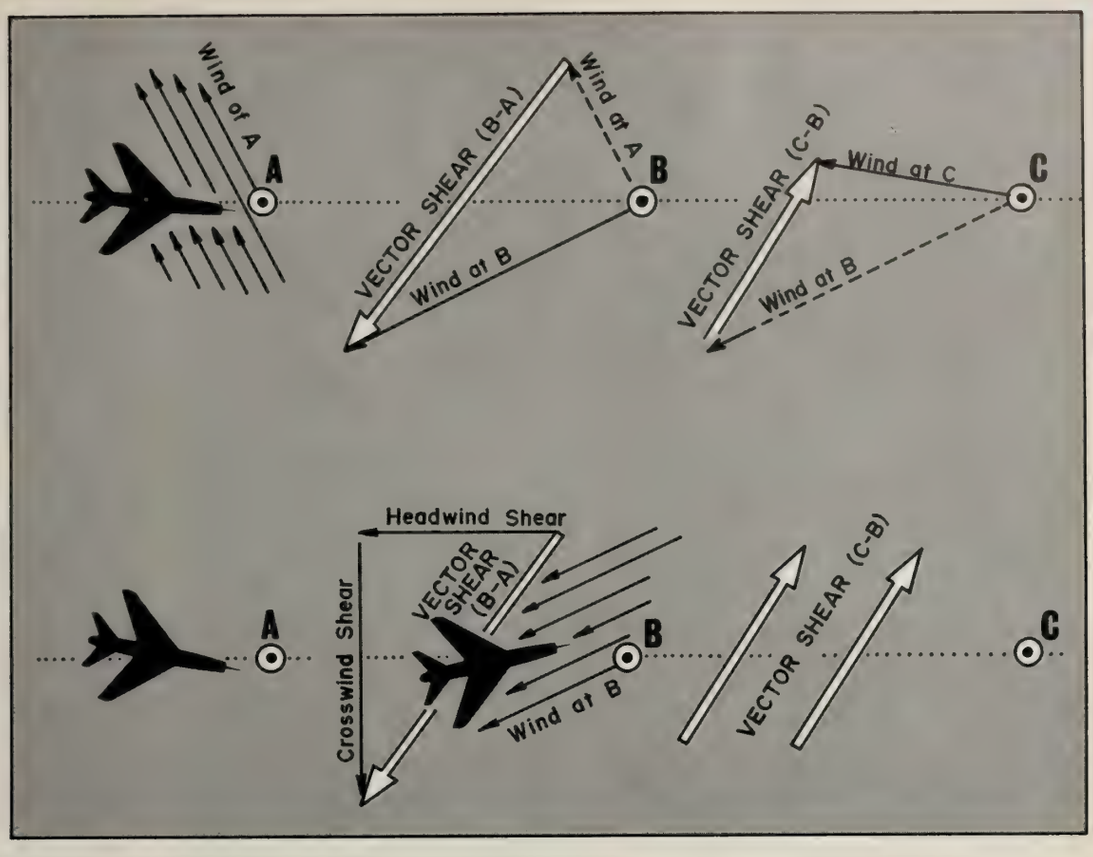
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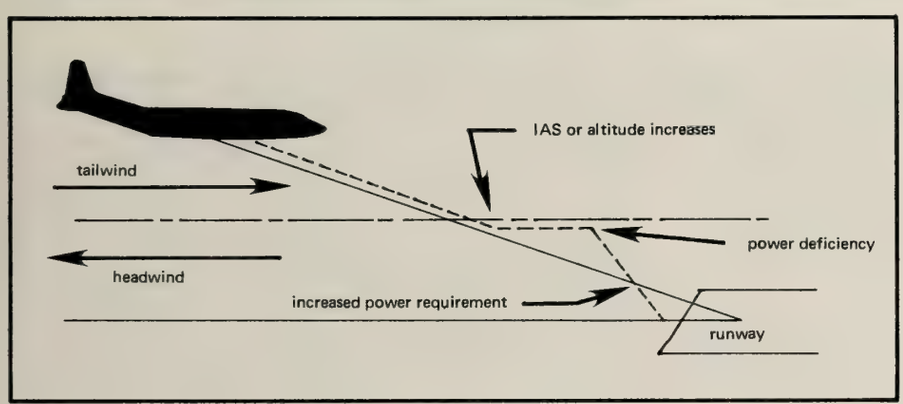
The effects of downburst and outburst gusts upon aircraft during a final approach. Of these the most dangerous are downburst and tailwind burst encountered near the ground. Outburst is defined as the strong outflow created when a downburst hits the ground and spreads out.



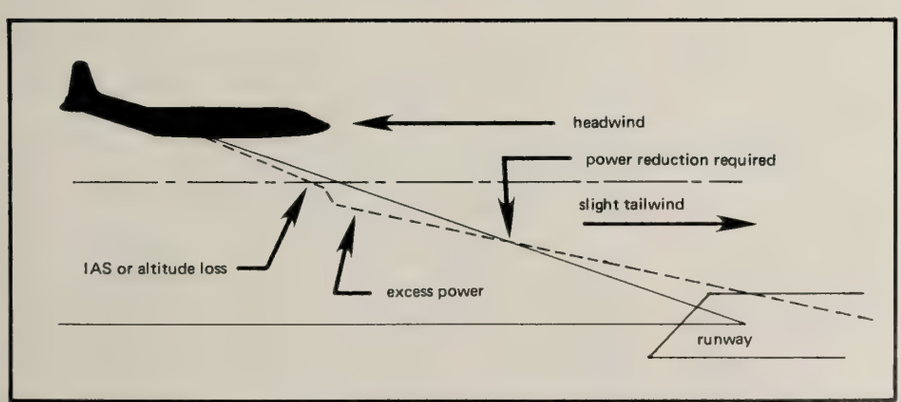
One of the most common and dangerous types of wind shear. Warm air moving above a pocket of cool, calm air may produce a shear a short distance above the airport.



A graphic depiction of vector shear, headwind shear, and crosswind shear likely to be encountered by an aircraft flying in or near a downburst cell.



An approach profile with a tailwind to headwind shear.



An approach profile with a headwind changing to a slight tailwind.



FOOD PREPARATION

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3636 Combat Crew Training Wing
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"Waste not, want not." Though this old adage is not in line with today's fast moving plastic society, it is a must in any survival or PW situation where you, the aircrew member, must use all that is available to you.

People have died because they failed or refused to fully exploit their food resources. How would eating the eye or brain of an animal, to replace the loss of body salt, sit with you? Could you cut into an animal's stomach and eat half digested food? Now, we're not trying to turn your stomach or put the fear of survival into you, but that *is* food utilization!

How does this relate to food preparation? Preparation is more than tossing a piece of meat into a skillet, frying to taste, and gulping it down. Food preparation, by definition, is the act or process of making ready, or in our case, using your resources to the maximum. Food preparation begins with the kill and ends with the meat cooked.

Prior to the preparation of the food, you should first consider the type of game vs the means of transportation. If you cave in a bunny's head, no sweat. You can gut and skin it on the spot; then quarter and cook it back at your camp. However, if you tackle (not a recommended technique) a large animal that can't be moved easily, you might opt to bring your camp to the kill. A large animal requires some time in preparation, so the less effort you expend, the better off you'll be.

The steps in food preparation are not complicated nor do they follow a precise order. In fact, some steps may be left out completely. It depends on the type and size of animal. The steps generally are as follows: bleed, cut, skin, quarter and cook.

Is bleeding, throat cutting, really necessary? For the most part, no. Small animals contain so little blood that it would not be worth your while. A large animal should be bled, providing it has not been shot. The shot animal should be gutted as soon as possible and the blood in the cavities retrieved. Note: Blood in the abdominal cavity will most likely be contaminated—avoid it. Blood can be used in making sausage and can serve as a salt substitute. Remember, blood is not a substitute for drinking water.

Gutting is one of the most critical steps and should be accomplished as soon after the kill as possible. After a period of time, the ungutted animal will start to decay and spoil. Care should be exercised in the removal of the internal organs, especially the sex organs and intestines. The contents will quickly ruin the best of meats. Save all the internal organs because most are edible. The heart, lungs, liver, stomach and kidneys as well as the tongue, eyes and the brain, can be well utilized. Note: In the arctic the livers of all animals should be avoided because of high Vitamin A content. Some may be all right, but it's best not to take

the chance.

Skinning, a step you will want to accomplish as soon as reasonably practical, will aid in the cooling of the animal. A large animal left unskinned is an ideal place for bacterial growth. A small animal's hide will normally pull off easily, but you're probably going to have to cut the hide off of large animals. Any hides are useful and their use is limited by your imagination only.

The primary purpose of quartering is to permit easier handling of the meat. Cut the animal into major parts or sections. Then wrap and store in a cool place away from insects and other animals. In the winter, cut the meat into meal size chunks and allow it to freeze. If you don't, you'll need a chain saw to cut a steak from a frozen carcass.

Cooking of most foods, including meat, is not necessary. Not having to cook meat has two advantages: It precludes making a fire in an E&E situation and the maximum number of nutrients can be consumed. Of course, there are some disadvantages. Eating raw meat exposes you to diseases in the meat, and the psychological repugnance has to be combated.

Then why do we cook our foods? Cooking makes foods more appealing, both in appearance and smell, more palatable and safer. To a large degree, though, most of these factors are purely psychological.

Though you may have a favorite cooking method, in a survival situation you must consider the nutritional aspect and the availability of cooking utensils. Boiling is the most efficient cooking method because you can eat the meat and drink the broth to get the maximum number of nutrients. But to boil your food you need a pot or similar container (don't forget the ration tin). Roasting is the next best method of cooking. You may roast your game in the coals or flames of a fire. By coating your game with mud and placing it in the coals, the meat will cook and reduce the loss of the food by burning. Fish and birds may also be cooked in this manner and won't need to be scaled or plucked. To spit cook, a form of roasting, impale your game on a stick and cook to taste over the flames or coals.

Baking, next in cooking preference, is a method used virtually worldwide. By wrapping your game in moist parachute material, certain palm leaves or the like, and burying it in the earth below the fire, the heat will bake your game. Frying your game is the least desirable way of cooking but the fastest. Some of the nutrients are destroyed by frying.



FOOD PREPARATION

continued





Getting the most food from your kill is important in any survival situation. Before you discard any portion of the animal, think first and decide if you really could live without it.

You may suddenly find yourself dependent upon your own resources for survival. Preparing yourself for an emergency costs very little in terms of time, money and effort and, considering the stakes, can be a very wise investment. Each year more and more people become lost or stranded in the wilderness. Some will succumb needlessly because they lack the knowledge or ability to make it.

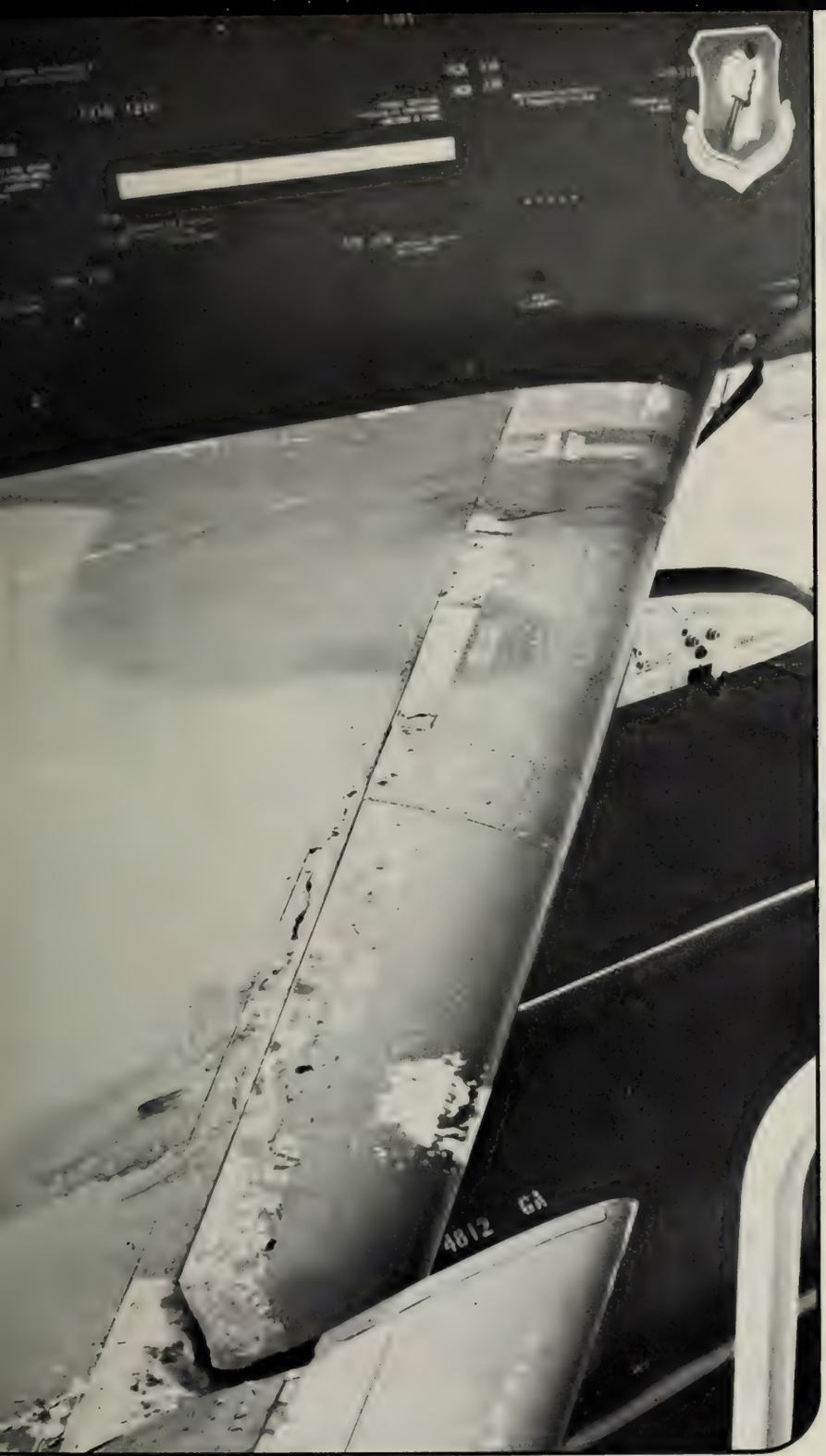
In the last three articles we have tried to give you a brief glimpse into the importance of food, food procurement and food preparation. You can't fight the wilderness—you must make it work for you.

Questions or comments concerning the survival articles may be referred to the 3636 CCTW/DOO, Fairchild AFB WA 99011 or AUTOVON 352-5470. ★

Photographs by A1C Mike McCowen, 3636 CCTW



F-4 BLC--Blessing or Burden?



LT COL J. P. CLINE
Directorate of Aerospace Safety

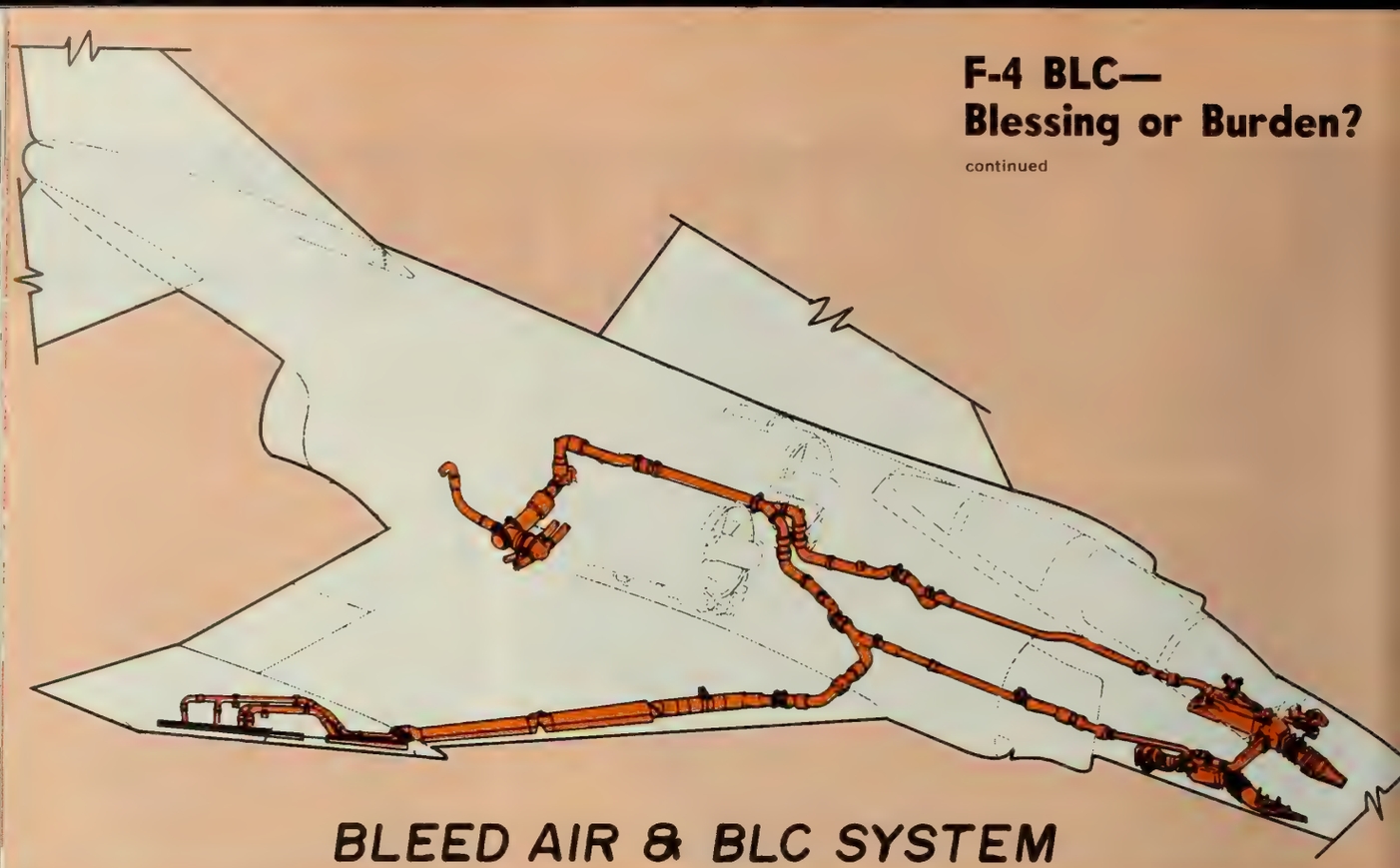
There has been much heated debate in recent years over the fate of the F-4 boundary layer control (BLC). For those of you who fly and maintain the slat birds, this is simply an academic discussion. But, the people involved with the Cs, Ds and RFs will be personally affected by the operational and maintenance ramifications of the decisions. You may be interested in a summary of how we ended up with BLC in the first place, the problems with the system, and possible causes of action from here. You may want to have a voice in the outcome.

A little discussion of aerodynamic evolution helps us partially understand the compromises and gadgets we live with today. In trying to meet operational needs, we have expanded aircraft airspeed envelopes from 100 knots to 2,000 knots. The design problem remains rather simple when an aircraft has a top end of 150 knots and lands at 50 knots. But when the bird is to go Mach 2+, and still land at some reasonable speed, the designer has to pull some tricks out of the bag.

We first saw the addition of flaps to the trailing edge of the wing to increase the wing camber,

F-4 BLC— Blessing or Burden?

continued



BLEED AIR & BLC SYSTEM

allow a slower stall speed and provide drag. As we moved into higher performance aircraft, we saw leading edge flaps and slats to further increase the wing camber as well as to energize the boundary layer over the wing. When the F-4 was coming into the picture, the contemporary supersonic fighters were scooting down final approach at 175 knots and up. Since the F-4 was being built for the Navy to land on carriers, these high landing speeds were unacceptable. Therefore, we saw the addition of BLC.

This system directs engine bleed air through slots along the leading and trailing edge of the wing over the upper wing surface and trailing edge flaps. The bleed air delays flow separation over the air foil. The result is lower stall speed thus lower allowable landing speed as well as improved low speed stability. As we have seen on some recent aircraft, other ways to change the aerodynamic characteristics of a wing are to vary the angles of incidence or sweep. The whole idea is to design a wing that can move through the air at high speed and still support the aircraft at slow speeds.

In many cases, we have seen a great number of trade offs and problems. The F-4 BLC system has been a source of many maintenance headaches and the cause for loss of operational missions. When the leading edge slat (LES) modification was installed on the F-4E, the entire BLC system was removed. The leading edge slat replaced the function of the leading edge BLC and the 12 to 14-knot increase in landing speed was determined to be an acceptable trade off for the elimination of the trailing edge BLC problems. The BLC problems fall into three categories: duct rupture, valve malfunction and inadequacies of warning devices.

Engine bleed air from the 17th stage of the compressor is used for BLC as well as for air conditioning, pressurization and equipment cooling. The bleed air is about 900 degrees F when it leaves the engine and any rupture in the system produces a significant fire potential. The feed duct that carries the bleed air to the wing trailing edge has been particularly vulnerable to failure and passes through an area of the engine bay which lacks any fire or heat detection. These ducts are now being made of an improved material (Inconel 625) and a retrofit program is in progress. This will reduce the probability of failure but the fire potential, in case of failure, remains unchanged.

The bleed air is directed into the wing ducts through valves located at the leading and trailing edge wing root. Herein lies the major source of BLC failures. The valves are linked mechanically to the leading and trailing edge flaps in each wing so as to allow an air flow only when the flaps are down (full down in the case of trailing edge flaps). Associated warning devices are designed to alert the pilot when any of the valves are open but flaps are up. This undesired configuration allows the hot bleed air to flow out of the BLC ports but traps it in an area not designed to withstand the high

temperature bleed air. Unfortunately, the valves can fail in such a way that the warning system thinks all is well.

Redesign of the valves is not feasible but improved care and inspection of the valves can reduce (not eliminate) failures. A redundant warning system which would sense abnormally high pressure in the ducts was proposed but rejected due to cost.

So, where are we now? We want to retain the BLC system because of the reduced landing speeds. We want to improve the BLC system to eliminate the costly failures. We have severe budgetary constraints that limit desirable modifications. It boils down to the fact that we will just have to live with a continuation of most BLC failures. A few figures will illustrate the scope of the problem. The trailing edge BLC accounts for over 25 reportable mishaps, nearly 100 aborts, and over 1,000 failures of some kind annually.

An alternative, that has been proposed, is to cap off the trailing edge BLC at the engine. This would eliminate the potential feed duct failures as well as the numerous trailing edge valve failures. The dollar cost would be quite small but the operational cost would be an additional 12-14 knots on final or in other words, an approach like the slat model. And, like the slat model, the approach configuration would be one-half trailing edge flaps due to excessive buffet with full flaps and no BLC. Without BLC, the trailing edge flaps only add drag and very little lift going from one-half to full. The leading edge BLC cannot be capped off due to unacceptable stability trade offs. In the slat model, it was traded for the leading edge slats.



This is typical damage caused by a BLC duct failure (top). The actual failed duct is shown in the bottom photograph.

If nothing is done, we will continue seeing aborts, incidents and occasional accidents as well as an exorbitant consumption of maintenance man-hours all caused by failures and malfunctions of the BLC system. A total fix would be cost prohibitive and still may not eliminate all failures. To go the other direction and cap off the trailing edge would eliminate many failures but would degrade landing performance. Mark III antiskid, which is now being installed, will mitigate the landing distance part of this problem.

The final answer is compromise. Within the constraints of cost and technology, we must decide on a course of action that will optimize the F-4 capability. Can we live with the BLC hazards so as to retain the slower landing speeds? Can we live with a higher landing speed so as to eliminate BLC hazards? From our vantage point, it appears that the best course of action would be to cap off the trailing edge BLC. Everyone involved with the F-4Cs, Ds and RFs should be knowledgeable, concerned, and anxious to see a solution. ★

THE IFC APPROACH

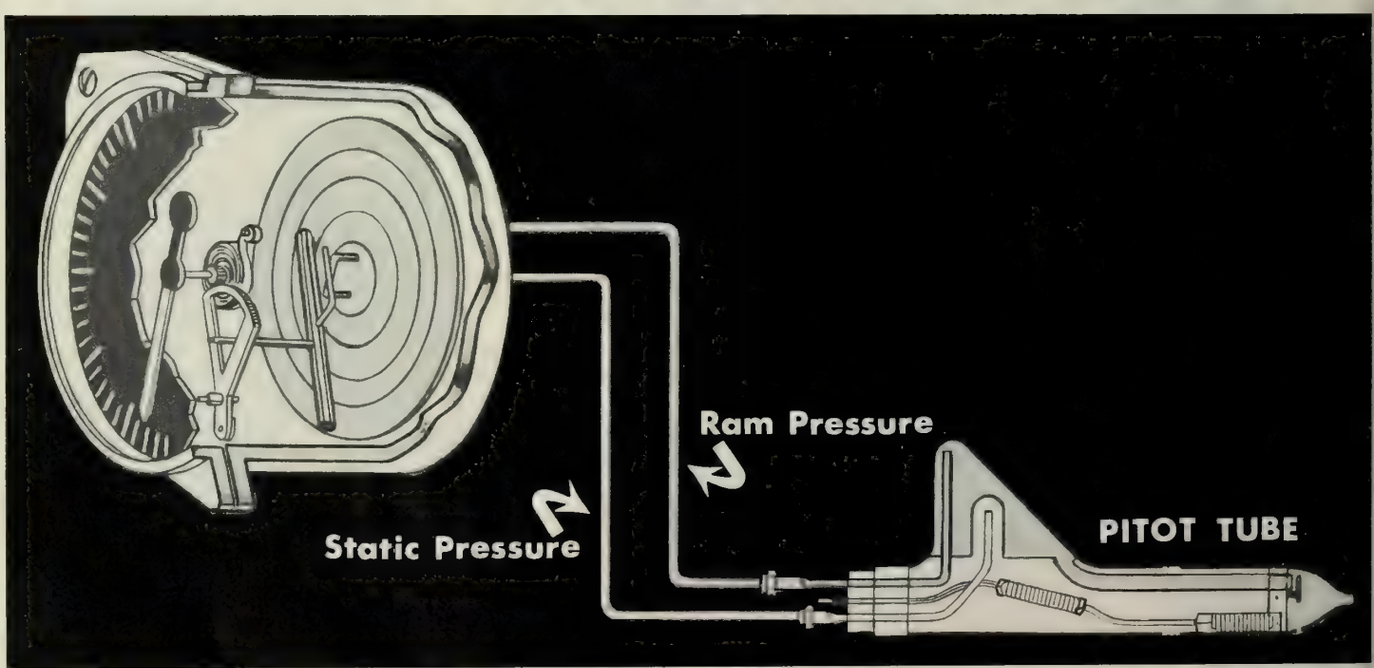
How long would it take you to notice an airspeed indicator malfunction? If something didn't look right in your cross-check, how quickly would you suspect an error in the airspeed indicating system?

Aircrew instinct to rely heavily on airspeed is brought to light by a Boeing 727 accident. On this flight the pitot heat was inadvertently left off prior to departure. The cockpit voice recordings indicate that during the climb the crew noticed the airspeed increasing. As they climbed, the airspeed continued to increase. From 16,000 feet to 24,800 feet the airspeed increased from 305 knots to 420 knots. They continued to increase pitch attitude (up to 30°) and reduce power to keep the airspeed below the critical mach for the aircraft. Indicated vertical velocity was more than 6,500 feet per minute rate of climb. When the stick shaker indicated a stall warning, the crew believed it to be a high mach buffet. The aircraft stalled, went out of control and crashed, killing the three crewmembers. The gross weight of the aircraft was less than the crew was accustomed to. Did that lead them into believing their aircraft's climbing performance?

You may be thinking to yourself, "How could the crew of that 727 not have noticed and realized the problem was an erroneous airspeed indication?" MSgt Roy Jones, a simulator instructor at Williams AFB, says that he can put unsuspecting pilots in the same situation that the 727 crew encountered, and nine times out of 10 they will react in the same way. This reaction to airspeed errors is not limited to the inexperienced pilot, but to the "old head" as well.

A review of pitot and static systems and how the blockage of either or both systems will affect the cockpit indications is important to understanding how to recognize erroneous indications.

Operating Principle of the Airspeed Indicator



Airspeed measurements are a comparison of pitot (ram) pressure to static (ambient) pressure. The difference between these two pressures is differential (dynamic) pressure. The airspeed indicator measures this dynamic pressure by supplying pitot pressure to the airtight chamber which surrounds the diaphragm.

When the pitot system is blocked by something, such as ice, the ram pressure is trapped and the static pressure is not; thus, the airspeed indicator acts as an altimeter. When the aircraft climbs, airspeed indication increases as the static pressure decreases.

Some aircraft have the static source located on the pitot boom. If the boom ices over, both systems will most likely be blocked. In this case the airspeed will remain constant, indicating the airspeed at which the blockage occurred.

On subsonic aircraft the static ports are located at a position on the aircraft not significantly influenced by the airstream. If the static source is blocked and the pitot boom is not, the airspeed will decrease as the aircraft climbs. This situation is possible even with the pitot heat operating, since most aircraft do not have static port heaters.

The most important action you should take if you suspect an airspeed error is establish a known pitch attitude and power setting; then, check the pitot heat on and the circuit breakers in. Next, check the attitude indicator against the standby attitude indicator, or against the other pilot's indicator. Crosscheck the angle of attack indicator, if available.

Some aircraft have an alternate static source located in the cockpit for use in the event the static ports become blocked. If a cockpit alternate static source is not available, you can make one by breaking the glass seal on any instrument using static pressure, such as the VVI, Altimeter, Airspeed Indicator, Mach Indicator, etc. Select an instrument that is not mandatory for recovery, such as the Mach Indicator. In the event it becomes necessary to use in the cockpit alternate static source, don't forget that you will have to dump cabin pressure. You may, as a result, have to descend to comply with AFR 60-16 oxygen requirements.

An IMC recovery without airspeed or angle of attack would be, to say the least, difficult. The best idea would be to find good weather and remain VMC until landing. If that's not possible, a join-up and formation recovery would be appropriate for those having that capability.

If neither of the above is possible, MSgt Roy Jones offers a technique that he teaches in the simulator. The technique is basically to experiment in the simulator and in the aircraft (in good weather) to determine the pitch and power requirements that are needed for the different maneuvers needed to get the machine back on the ground. The pitch and power requirements must of course be noted so you can use them later if you decide to accept the mission of an IMC recovery without airspeed. Here are the most important items to note:

1. Prior to takeoff and on level ground, set the attitude indicator pitch trim knob so that the arrow is on the index. *Do not change this setting.* The flight manual will tell you what the pitch picture should be while on level ground. For example, the T-38 is 3° below the horizon; the T-39 is 3° below the horizon; and the T-37 is level, 0°.

2. After takeoff, establish normal cruise airspeed and note the pitch indication and power setting required to maintain zero vertical velocity. This indication is based on a percentage of stall which automatically corrects for weight.

3. Establish gear extension airspeed in level flight and note the pitch and power setting. This pitch picture will be needed to ensure you do not exceed the gear extension airspeed during your recovery without an operable airspeed indicator.

4. Establish final approach airspeed and configuration. With zero VVI, note the attitude indication.

5. Once you are established on final approach with zero VVI, trim the aircraft. To begin the final approach descent, lower the nose the number of degrees required for the approach and control the rate of descent with power. Do not re-trim the aircraft since it is trimmed for final approach airspeed.

This technique is used to determine the pitch attitudes required for different airspeeds and configurations (L/D ratio). The important aspect to remember is, if you hold your predetermined pitch attitude and power setting and the VVI is zero, the aircraft will not stall. Trim is extremely important. Once the aircraft is trimmed for an airspeed, power will control the rate of climb and descent. The L/D ratio is a function of angle of attack and will remain constant regardless of weight, provided the trim is not changed. Since different airspeeds are required for each aircraft weight, you should learn the following key attitude pictures:

1. Holding
2. Penetration

IFC Approach

continued

3. Maximum gear extension
4. Instrument maneuvering (Normally 1.4% of stall speed)
5. Final approach (Normally 1.3% of stall speed)
6. Landing (Normally 1.1% of stall speed)

Remember, don't try this approach technique without practice in VMC. Treat it as a last resort measure for a weather recovery. Anytime you are out of control and have the capability, do not delay ejection to a point where you are below the flight manual's recommended minimum ejection altitude.



If you need an alternate static source in an emergency, break the glass on one of these instruments (pick one you can afford to do without).

CORRECTION

Since writing the March 1976 article, we have obtained additional clarification from the FAA. If you keep copies of the articles, make a note that the first question and answer under LOST COMMUNICATIONS — EN ROUTE should read as follows:

"Q: If a pilot experiences radio failure after he has been given an en route clearance limit and an expect further clearance (EFC) time, what does ATC expect him to do when he reaches the clearance limit fix?

A: Hold at the clearance limit fix in a charted holding pattern or, if no holding pattern is published, hold on the inbound course in a standard holding pattern. Depart the clearance limit at the EFC and proceed by either, (1) the route assigned in the last ATC clearance, (2) in the absence of an assigned route, by the route that ATC has advised may be expected, or (3) in the absence of an assigned route or a route that ATC has advised may be expected, by the route filed in your flight plan."

Help the USAFIFC help you. If you have recommendations or suggestions which will improve instrument flying—let us know. Call AUTOVON 487-4276/4884. ★

OPS TOPICS

STRESS CORROSION

The T-43 was taxiing for takeoff when the number two generator dropped off the line, and the crew detected a strange odor in the cabin. The aircraft was pulled off into a parking area, and the crew exited normally after engine shutdown. Maintenance troubleshooting uncovered the fact that the generator feeder wiring was burned through. This was the result of the mating of two dissimilar wires (copper and aluminum). This set up stress corrosion and high resistance in the wires with a result that the wires overheated and the splices failed. The unit involved has checked their other aircraft but found no further problems.

LOST DOOR

After the C-141 landed, the crew found that the APU oil service door was missing. The door had not been properly secured, and the scanner did not physically check the door during his thruflight inspection. The door was found on the runway after the aircraft had departed.

FAA CAUTIONS AIR TRAVELERS ABOUT CARRYING LOOSE BOOK MATCHES IN LUGGAGE



The Federal Aviation Administration has warned air travelers that it both is dangerous and illegal to carry loose book matches in their luggage.

The matches could ignite in a suitcase and start a smoldering fire that could ruin travelers' personal belongings. Moreover, there always is the danger of a small fire becoming a large one or triggering an explosion on an aircraft in flight.

Persons who carry loose book matches in their carry-on or checked luggage also are subject to fines for carrying hazardous materials on board an aircraft in violation of FAA regulations.

A fire can start when the cover of one match book is open and vibration or movement brings the heads of the matches into contact with the striking strip of another book, the agency said. The usual result is a small, smoldering fire in the suitcase with the damage confined to the contents of suitcase. But in one case an explosion resulted when the smoldering fire ignited the contents of a can of hair spray. Fortunately, the suitcase was not aboard an airplane at the time.

FAA said that twice in the last two months it has received reports of matches starting fires in luggage. Others may have been started and gone unreported, it added.

In one of the two cases, FAA said, the fire was discovered when a baggage handler noted smoke coming from the suitcase while unloading it from the aircraft. In the other, only two books of matches actually caught fire, but there were 89 other books of matches in the same suitcase that could have been ignited.

The FAA classifies matches as hazardous because the heads are a flammable solid. They can be legally carried on aircraft only when they are tightly packed in a closed container within the suitcase.

The penalty for violation of the regulation is a fine of up to $10,000. If criminal intent can be proved, the maximum penalty is a $25,000 fine, five years in prison, or both.

OPS TOPICS

LOAD SHIFT

A C-130 loadmaster had two toes crushed when an improperly secured pallet shifted on takeoff roll. This is the last in a series of mishaps involving unsecured cargo on pallets. This one was serious enough. Next time we may not be so lucky.

HARD TO EXPLAIN

The O-2 pilot reported to his aircraft at an X-C base for the return flight home. He waited awhile for transient alert service but when no one came the pilot preflighted and then started the aircraft alone. After receiving taxi clearance, the pilot left the parking spot and, as his attention was diverted toward clearing some other equipment, the aircraft struck a fire extinguisher stand about 10 feet in front of the parking spot.

A DIFFERENT (?) WAY

The helicopter was engaged in a cargo drop test. A qualified rescue specialist was standing beside the left jettisonable window hatch spotting the drop zone. Shortly after he moved away from the window it separated from the CH-3. The release was probably caused by clothing or the interphone cord moving the release handle. The unit has suggested a safety wire on the handle as a fix.

PILOT'S NOTICE

If you are going to Kelly AFB, be careful. Transient aircraft have been mistakenly landing on the parallel taxiway east of runway 15/32. This taxiway is marked with big (85 x 30 ft) letters that spell "Taxiway," and there is a note in the IFR supplement. Be sure you are lined up with the right piece of concrete before you touchdown. It can save some embarrasing moments later.

PROPER PREFLIGHT PREVENTS . . .

During postflight, the maintenance supervisor discovered damage to the helicopter fuselage. Apparently the damage was caused by a passenger seat belt left hanging outside the aircraft during the flight.

BIRDSTRIKE!

The F-4 was on a range mission. As the aircraft turned final, a bird hit the left side of the windscreen shattering it, and then struck the pilot on the left shoulder and left side of the helmet. Fortunately, the pilot had his head turned to the right at the time of impact so his face was somewhat protected. This is just one more good reason for keeping your visors down.

BAD SIGNAL

The UH-1 (owned by another service) took off on a routine mission. Shortly after takeoff, the rudders froze. The pilot returned to base and made a sliding landing. The KY-28 radio had slipped from its mount and lodged between the pilot's rudder pedals.

BLAST

When the pilot applied breakaway power to the RC-135 to move out of the chocks (this required almost 80 percent), the blast caused damage in a parking lot some distance behind the parking spot. In this day of high powered engines and heavy gross weights, it is essential that the aircrew be aware of what effect blast will have on objects or people.

OPS TOPICS

ANALYZE THE PROBLEM

The F-4 scrambled on an intercept training mission. During the second intercept, as the pilot maneuvered to complete the intercept, he rapidly retarded the throttles out of AB to prevent an overshoot. At this time the right engine flamed out. When the master caution and warning lights came on, the crew assumed that there was an oil system failure, and the pilot shut down the engine and made a single engine landing. The oil pressure and other indications were indicative of a flameout rather than oil system failure.

YOU HAVE TO LET THEM KNOW

The crew of an F-4 became hypoxic while at altitude and made an emergency descent. At the time, the F-4 was under the control of the range controller, not ARTC. The crew did not declare an emergency with the range controller, so when he turned the F-4 over to RAPCON, RAPCON was told that the aircraft had not declared an emergency. Ten minutes after the initial descent the F-4 crew declared an emergency with RAPCON. However, the transmission was blocked and the controller did not receive it. As a result, there was no emergency response at the recovery field. While there were several contributing factors in this misunderstanding the aircrew could have done a great deal to prevent it by, (1) declaring an emergency as soon as the emergency developed, (2) squawking emergency 7700 on the IFF. You have to let the controllers know what you want.

PHANTOM STRIKE

An F-4 was struck by lightning without the crew realizing it. The crew had been carefully avoiding build-ups that showed up on their radar. However, they flew almost the entire mission in cirrus clouds. Evidently, there was sufficient static build-up to produce a lightning discharge which damaged the left wing tank and wing tip light. Even if you don't fly directly into a build-up, conditions in cirrus clouds near such build-ups can produce lightning.

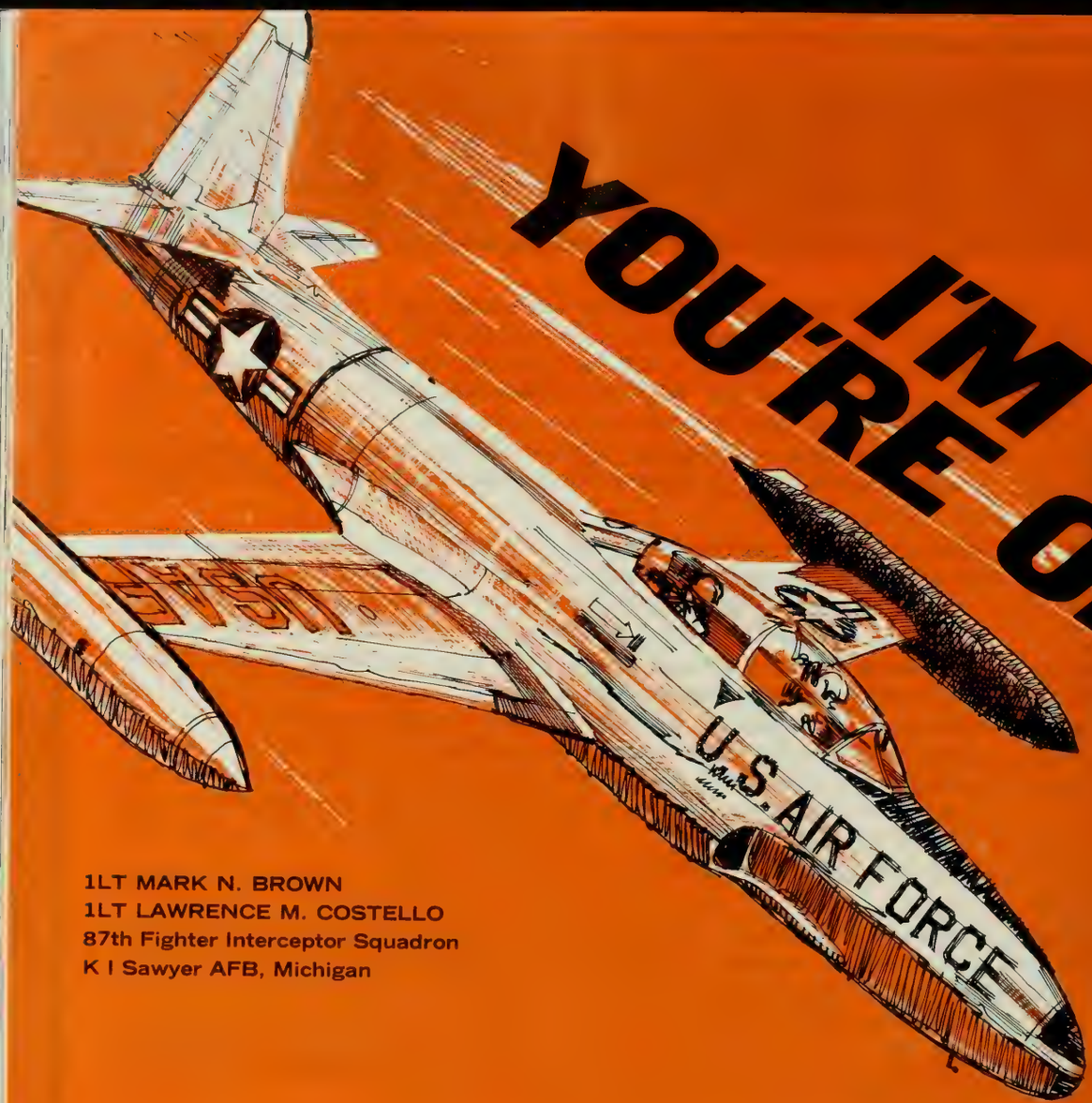
BE PREPARED

Just as the F-100 lifted off, a compressor stall occurred. The pilot cleared the stall and, because he was too far down the runway, continued the takeoff rather than abort. He flew a wide pattern and an uneventful straight-in approach to a successful landing. When maintenance looked at the engine they found two birds. While there was no real damage and the engine ran properly, the pilot had no way of knowing that at the time. The important thing is that this pilot had a plan. He obviously had thought about a situation like this, so when it happened he reacted correctly. How about you? Are you prepared?

FIRE LIGHT

The crew of the B-52 initiated an NRT climb to FL 350. In the climb the number eight fire light came on. Even though all engine indications were normal, the crew proceeded with the emergency procedure and shutdown the engine. After landing, they found a 1½-inch hole burned through the engine cowling and the adjacent area charred. It is a good idea to follow the Dash One procedure whenever there is a fire light. It just might save an aircraft. ★

I'M OK YOU'RE OK



1LT MARK N. BROWN
1LT LAWRENCE M. COSTELLO
87th Fighter Interceptor Squadron
K I Sawyer AFB, Michigan

The incident described in the following article is true. The aircraft involved was a T-33. The crew consisted of two first lieutenants of the 87th Fighter Interceptor Squadron. The two narratives that follow are the first-hand reports of what each pilot saw, felt, and did between the time of takeoff and the eventual safe recovery.

1LT MARK N. BROWN

Preflight and engine start were normal and all before-taxi checks were completed. The only abnormal thing I noticed came during the speed brake retraction. The hydraulic pressure drop was normal and the pressure did recover to the normal range; however, it seemed to me that it took slightly longer than usual to recover. While taxiing out to the active, Larry checked the navigation equipment while I did the remaining checks. Everything was functioning normally.

After being cleared for takeoff, I taxied onto the runway and performed a line-up check. Everything was still okay so I released brakes and made the takeoff. The weather was fairly low and I remember mentioning to Larry that we entered the weather at 1650 feet MSL. Field elevation is about 1220 feet MSL. I entered the weather doing 250 kts.

I rolled into a 5-10 degree left bank to start our turn out of traffic. Although my attitude indicator indicated that I was holding a constant bank angle, it felt to me like we were still rolling to the left. I shrugged it off as a slight case of the leans and concentrated on the departure. I noticed that my VVI was slowly decreasing from about 3000 fpm down to 2500 fpm, so I increased back pressure to maintain my rate of climb. I noticed that the airspeed was slowly decreasing from about 250 kts, and I felt I was in a 60 to 70 degree left bank and about 2 bar widths nose high.

I tried to roll out of the bank that the attitude indicator showed but the bar didn't move. My airspeed was still decreasing and I was holding an abnormal amount of back pressure to maintain my rate of climb.

Suddenly the VVI jumped and pegged itself at 6000 feet a minute climb. I was startled because my attitude on the J-8 hadn't changed. Larry told me to push the nose over and I released most of the back pressure. I was extremely confused at this point and thought that I must have vertigo, so I told Larry that I had vertigo and told him to take the aircraft.

I felt him shake the stick and take it. I was staring at my instruments trying to get my head on straight. My airspeed was slowly decreasing past 230 kts, my VVI was pegged at 6 grand climbing, we were passing about 6400 feet MSL, and yet my attitude indicator was showing a 5 degree left bank and two bar widths nose high. I also noticed that my heading indicator still showed my takeoff heading.

I felt Larry roll the aircraft to the right and noticed that my J-8 hadn't moved. Larry stopped the roll and increased the back pressure until we could feel the burble. It finally dawned on me that I didn't have vertigo but that my attitude indicator, which was now slowly rolling, was inop and yet there was no off flag.

Our VVI had now gone from 6000 fpm up to 3000 fpm down. We were passing 3600 feet and I put my hands on the handles and was about to order an ejection. Larry then told me that he was extremely disoriented. I was also staring at the partial panel at the time and thought we were in about a 30 degree right bank.

I took the aircraft passing about 3400 feet, rolled to the left until the turn needle centered and began increasing back pressure. The instruments indicated that we had stopped turning and were decreasing our rate of descent. We were passing 3200 feet or so at this time, and I decided to delay ejection since it appeared that I had the aircraft under control. We bottomed out in the dive at 2800 feet MSL. I held about a 1000 ft a min climb until we broke out on top at about 7000 feet. I remember being rather elated to see the sun.

1LT LAWRENCE M. COSTELLO

Everything went really smooth up through preflight, engine start and taxi. The only write-up in the forms was that my rear cockpit heading indicator sometimes would temporarily stick through 10 to 20 degrees of turn. I checked my heading indicator on the ground along with all the other navaids which checked out just fine.

On line-up, both my attitude indicator and heading indicator were good. We made a normal takeoff and started our climb into the weather. We entered the soup about 1600 feet MSL. That sort of sticks in my head because I mentioned to the forecaster that we would give him a call after departure.

As we entered the weather, Mark made a shallow left turn out of traffic to intercept our course outbound. We were now solely on instruments. I first noticed that my heading indicator hadn't moved but I felt a very positive rolling tendency to the left. My attitude indicator at this point showed us to be in approximately 10 degrees left bank with the aircraft silhouette still sitting on the horizon. Our airspeed showed us at approximately 250 kts. At this point, I felt a little vertigo coming on and remember thinking to myself that I was sort of glad Mark was flying. (Nobody likes flying with that "vertigo" feeling.)

The next thing I can remember noticing was that although I was tapping on the glass of my heading indicator, neither that nor my attitude indicator had budged. Simultaneously, as the VVI went from about 2000 fpm climb to 6000, my aircraft silhouette shot straight up and the horizon fell to the very bottom of the case.

I remember telling Mark to get the nose down. I now had the indication and the definite sensation that we were in a good 60 to 70 degree climb

with our airspeed decreasing through 220 kts. Mark told me he had a bad case of vertigo and gave me the aircraft. I thought for a second of trying to nose it over, but I felt we would have stalled before I could get the nose down and break the climb. I attempted some sort of a roll which I thought to be around 120 degrees and pulled to get the nose down. I had pulled to the point of a very apparent buffet indication, then relaxed the back pressure somewhat and started to initiate a roll-back.

At this point, I can remember my VVI going from 6000 fpm climb to a 3000 fpm descent and my attitude indicator apparently binding again on the horizon. Our airspeed was accelerating through 230 kts and I felt totally disoriented. I now told Mark I too had a bad case of vertigo and gave him back the aircraft. We were passing about 3500 MSL.

At that moment, when Mark took the aircraft, my feet went into the stirrups and my hands to the handles. I can vividly remember taking a few deep breaths in preparation for leaving the aircraft. I now felt Mark roll the plane slowly, and I began to feel the Gs as Mark started a smooth but positive pull out of the dive. I felt that we had gained control of the aircraft and had passed level flight.

We bottomed out at 2800 MSL. Mark transitioned to a shallow 1000 fpm climb and we broke out at about 7500 feet. That rich, blue sky has got to have been the best sight I've ever laid my eyes on. We started to check the aircraft to see if our tips were still there and if our ECM pods were still attached to the pylons. My G meter was registering 3½ positive Gs and one negative G. I can remember finding my approach plates on the floor and the glass holder laying up behind my left shoulder.

SUMMARY

Lt Col Brooks G. Bays
Operations Officer, 87 FIS

Here were two young pilots faced with a situation which would have curled the hair of even the most experienced of pilots. Their reaction to the situation and successful recovery of the aircraft was the result of one primary factor—PREPARATION!

Preparation for flight is a continuing day after day program. While it is a rather simple matter to prepare for an individual mission, we, as aircrews, must always be prepared for the unexpected things associated with FLIGHT. In this case there simply was not enough time for these young men to sit back and discuss the situation before taking action. *Positive* and *correct* action had to be taken immediately, or there would have been another smoking hole in the ground.

Let us look at some of the factors.

WEATHER: The reported weather for takeoff was something like 300 scattered, 600 broken, 1,200 overcast with 1½ miles of visibility.

MALFUNCTIONS: The probability of having both heading and attitude indicators fail simultaneously (without an inverter failure) is undoubtedly quite low. (Since having first flown the T-Bird in 1958, and spending a few years in safety, I cannot recall having ever heard of everything going at once like this.) However, in this instance, the crews were able to, first, recognize these insidious failures and, secondly, take the proper actions. When was the last time you tried to recover from unusual positions using only needle, ball, VVI, and airspeed? Perhaps on an instrument check, but doubtful. The old attitude indicator may have "popped up" in your cross-check, out of habit. The big point I am trying to make on this is that the crews were able to identify the erroneous indications by cross-checking other instruments. Then, after they got that sorted out, recover the aircraft, using what was left.

CREW COORDINATION: I believe that crew coordination was probably the most important factor in the safe recovery of this aircraft. They had flown together many times and were each confident of the capabilities of the other. They communicated—Larry telling Mark to get the nose down. Each telling the other when he was disoriented. Shaking the stick when taking control of the aircraft.

JUDGMENT: While I applaud their successful efforts to save the aircraft, I would have faulted neither had they elected to pull the handles. Certainly those who were less prepared might have taken that option. However, they knew the terrain and the weather. Each man was prepared to eject, mentally and physically. But most importantly, based on the information available only to them in the cockpit, they were in agreement that the situation had not yet deteriorated to the point where ejection was necessary. And, they were right.

In summary, these young men were PREPARED for flight. That preparation did not begin 2 hours before the flight, the night before, or even the week before. It began when they entered UPT, and has been continued through an aggressive training program in the squadron. They are continuing that preparation today. Mark is at Tyndall, checking out in the F-106 and by the time you read this, Larry will have completed upgrade to IP in the T-33. ★

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TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



First Lieutenant

THOMAS R. GORMAN

102d Fighter Interceptor Group
Massachusetts Air National Guard
Otis Air Force Base, Massachusetts

On 5 November 1975 Lieutenant Gorman, piloting an F-106A, was on a routine flight that proceeded normally until, at 35,000 feet and 30 miles west of Albany, New York, the master caution warning light and oil pressure light suddenly illuminated accompanied by the oil pressure gauge indicating zero oil pressure. Lieutenant Gorman immediately started a turn back to Albany and declared an emergency with the RCC. Before he received a reply, all aircraft systems failed and the engine flamed out. Seconds later the flight controls froze. Lieutenant Gorman immediately deployed the ram air turbine, regaining use of the primary flight control system. Unable to inform any agency of his critical emergency and having only battery power available, Lieutenant Gorman reviewed checklist procedures in preparation for ejection. After analyzing his position, altitude, weather and runway environment, he made the decision to attempt a flameout landing at Albany Airport. Lieutenant Gorman successfully maneuvered the aircraft to arrive at an 11,500 foot high key, 90 degrees to the runway heading. Deprived of all cockpit instruments except the airspeed indicator and altimeter, Lieutenant Gorman began a right descending 270° turn toward the runway. He delayed the decision to emergency extend the landing gear until he was sure he could make the runway, then rolled out on a short final for a precision landing 500 feet down the 6000 foot runway. Maintenance and safety personnel subsequently determined that the engine accessory drive case had cracked, due to internal failure, which resulted in the complete failure of the engine and all related aircraft sub systems. Lieutenant Gorman's exceptional skill, judgment, and rapid assessment of the situation were responsible for the successful recovery of a valuable aircraft. WELL DONE! ★

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FOR MORE INFORMATION SEE PAGE FOURTEEN.

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UNITED STATES AIR FORCE

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OCTOBER 1976

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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OCTOBER 1976 AFPR 127-2 VOLUME 32 NUMBER 10

SIMULATORS

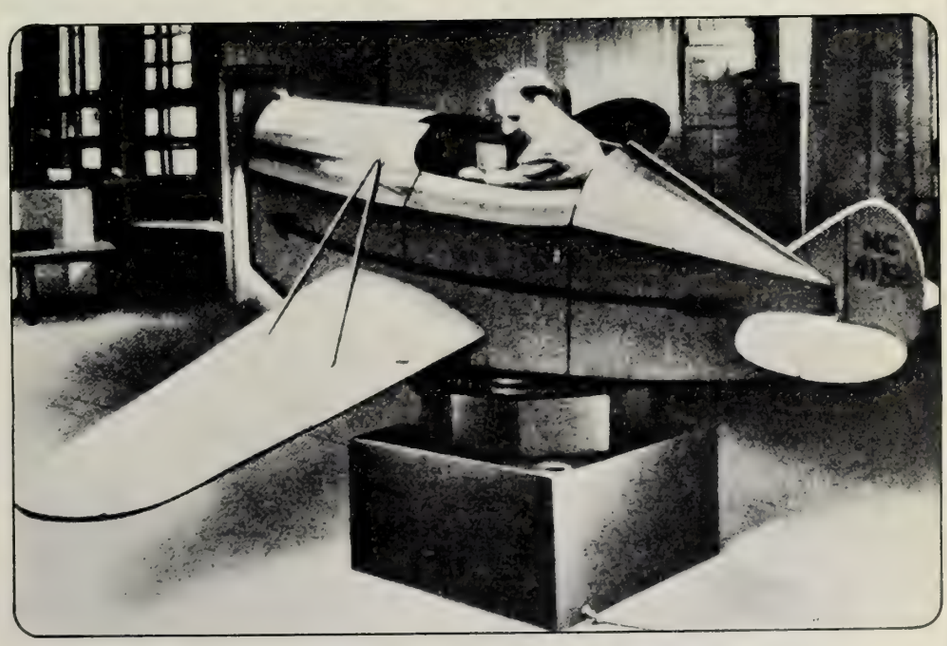
ANCHARD F. ZELLER, PhD
Directorate of Aerospace Safety

So you, like most aircrew members, never really cared a great deal for simulators, could take them or leave them, but would rather leave them. Well, chances are that is going to change. You may not have a genuine fondness for simulation devices, but you do have a very real fondness for two things, both of which will most certainly become increasingly dependent on their use. The first of these is that desirable addition to your monthly income known as flight pay. And the second is that posterior segment of your anatomy which you would not like to bust, but which you very well might if your proficiency is not up to par—not proficiency in the simulator, you understand, but proficiency in your aircraft, which you may only get to fly on rare, possibly critical, occasions.

Although the petroleum shortage has been given credit for many of the changes which have taken place or are proposed in flying, it is only one of many variables forcing greater consideration, greater use, of simulation devices. It is no secret that the cost of many of our weapon systems is becoming very high; not only very high to procure, but even higher to replace. This means that accidents, which have always had a major impact on preparedness, have become critical. The loss of even one of our more expensive and sophisticated aircraft can have a very measurable detrimental effect on our defense capability.

While our aircraft have become more expensive and more complex, in many instances their flying life is markedly less than that of some of their sturdier, lower performance predecessors. This means that we cannot afford the luxury of using the aircraft itself for extensive training. Even though the training is performed safely with no accidents, the impact on the life expectancy of the system is such that every possible avenue for maintaining proficiency without aircraft wear and tear must be explored.

Another sometimes unrecognized fact is that some things can be taught better in a simulator and certainly more safely than they can in the aircraft itself. A pilot training in air combat maneuvers in a simulator can get more experience quicker than many of his predecessors have had in a lifetime of flying. In the



We have come a long way in simulator developments from this early model.

SIMULATORS

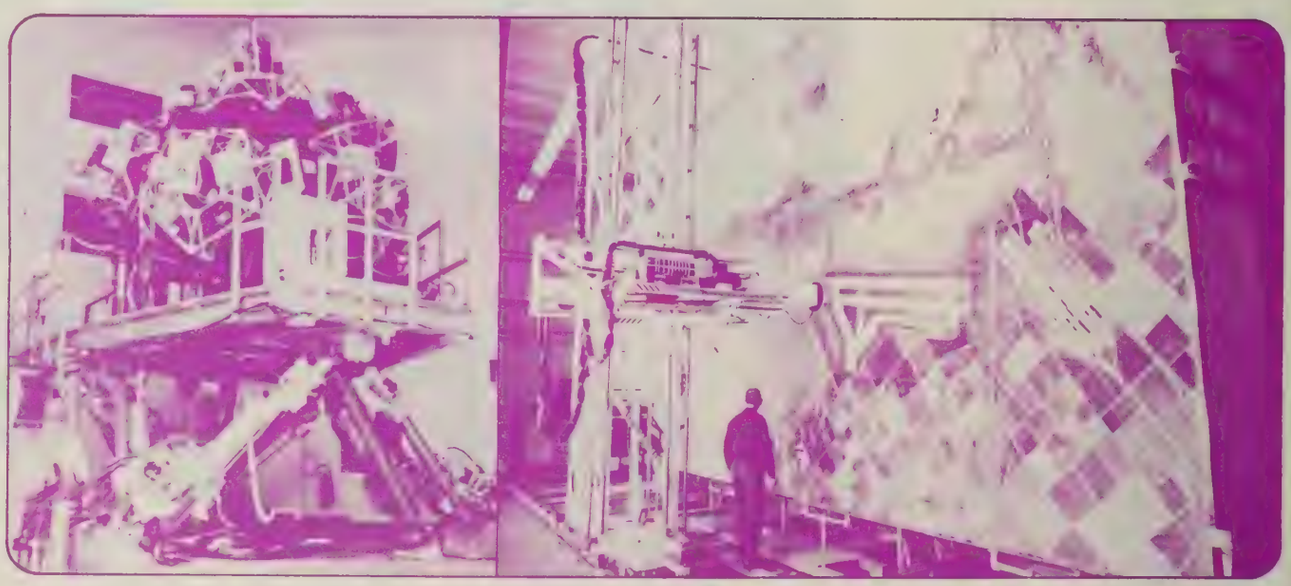
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simulator, flying against an opponent who doesn't make mistakes and who takes every advantage of those made by the flier, an expertise can be developed in the average pilot which only the most talented few survived long enough to develop in the real world of combat. The sophisticated software of a modern computer, with its ability to multiply options and its replay capability, is indeed a positive adjunct to the simulation field.

This is not meant to imply that the make-believe world of simulation is about to supplant the cold, harsh world of reality. Far from it. Although simulators were around even before Mr. Link discovered that he could train pilots faster and cheaper, and hence get more students, by using a simulator, their general acceptance has been less than totally enthusiastic. The reasons for this are quite simple: pilots are pilots because they like to fly. Other airmen chose their professions for the same reason. It was reasonable, therefore, that anything which in any way threatened to decrease the amount of flying was looked upon with suspicion and, consequently, little encouragement was given to developing such devices. The result has been that, in spite of the current proliferation of devices, there is a goodly number of questions which must be resolved before an integrated simulator program which will optimally meet the Air Force's needs is developed.

One of the questions currently being addressed which must be resolved is what kind of simulators really need to be developed for the various piloting tasks? It is obvious that the simulators for the novice learning the routines of taking off and landing must be very different from the highly sophisticated air combat simulators mentioned previously. Surprising as it seems, it also needs to be determined what degree of sophistication or precise simulation is required for optimum learning. There is a real possibility that simple part-task trainers will result in better and faster learning than the most sophisticated devices. They would also be cheaper, and the more complex pieces of equipment could be reserved for putting together a number of the part tasks learned in a simpler setting.

One of the concepts of simulation which has been pursued by many is



Left—The advanced simulator for undergraduate pilot training. It is a T-37 cockpit with 7 visual displays and 6 degrees of movement. Right —This is the visual display model board used as one method of depicting visual display on newer simulators.



A major advantage of the new simulators is ability to simulate complex or even untried tasks. On the left, a pilot simulates combat 2 on 1 with F-15s against a MIG. On the right, an experiment simulating air refueling F-15s with a DC-10.

that the simulator should be essentially a duplication of the aircraft. There is good reason to believe that this is not necessarily so. The exact degree to which precise simulation must be pursued needs to be further explored. It is self-apparent but not necessarily valid that, because an aircraft is a moving body, a simulator should move. With a highly developed visual system, however, it is quite possible that the human body responds to visual cues received as it would if motion were actually involved. The sophisticated motion systems may not need to be employed except with discrimination and selectivity. Anyone who has ever sat in a train and had an adjacent train move knows the very real sense of movement which can be generated by a visual cue. This experience is so standard that it is referred to as the train illusion and can be experienced from automobile movement or in any other context where the major portion of the visual field is moving, even though the observer is static.

It also appears quite possible that movement may be simulated by the use of G-suits and G-seats, which, by applying pressure to the body, produce the same sensory cues as the individual would get if actual movement were involved. The role of these variables is being explored and, I hope, the results will be incorporated in newer equipment.

Some other questions which have not been as thoroughly answered as they should be relate to transfer of learning. It must always be kept in mind that the use of any simulated device is only incidental to learning a basic task in the equipment actually being simulated. If the learning doesn't transfer directly, little has been gained. In fact, if the procedures learned are in conflict with the same procedures in the basic equipment, then something has been lost, as an erroneous set of behaviors has been learned. This, re-



The state of the art for computer generated visual imagery is impressive. These two pictures are what the pilot would see in the simulator on final approach under either IMC (left) or night (right).

SIMULATORS

continued

ferred to as negative transfer, is always a possibility.

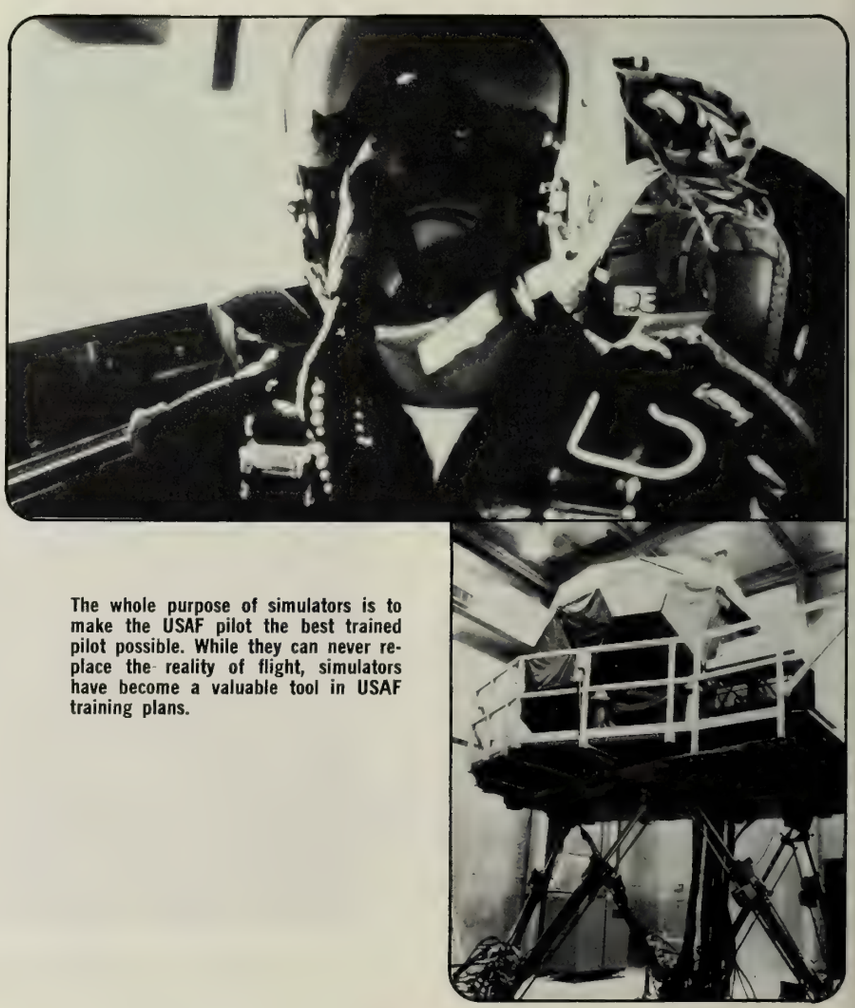
One of the greatest potentials in the simulator world is not in the hardware per se, but in the ingenious programming (or software) which drives the hardware. This is one of the most open fields in the simulator business. The learning potential of air combat maneuvers with an enemy who never makes a mistake and the possible use of a computer to optimize your own maneuvers offer limitless possibilities. On a real-time basis, these have some defined limitations. If time can be permitted for computer iterations, the potential for logic decision making is almost infinite.

To get back to reality, while these esoteric predictions are certainly valid and sometimes overwhelming, some uncertainties remain. There needs to be a definition of what is to be learned, what kinds of equipment are required, what the characteristics of these must be, and how these are to be used. Only as these basic and not fully documented questions are answered can maximum exploitation of the major sophistications be possible.

This brings into focus a consideration for all simulator use—those which we now have and those which may be forthcoming. No piece of equipment is of particular value unless its potentials are exploited to a maximum. It is doubtful that anyone in charge of a simulator program could be found who would assert that his simulation devices, whatever they are, are currently being used to their maximum, that a program has been consciously developed to make use of every minute of training time, that instructors have been carefully chosen and trained, and that the crewmen flying have been exercised to the extent of their competence. One is acutely aware of the many times that a crewman has entered a simulator, put in his time, and climbed out.

It is as possible in a simulator to get one hour of experience a thousand times, as it is in the aircraft. This motivation is almost certainly going to change, however. For one thing, the shrewd crewman will know that his proficiency has become marginal and that he must use every possible aid to assure that when he does fly his equipment, he can do so both efficiently and safely. And for another, his flight pay may well depend upon simulator accomplishment, possibly based on stan evals conducted in the simulator. Even now, in our sister service, the Navy, portions of a pilot's annual flight requirements for flight pay can be accomplished in the simulator.

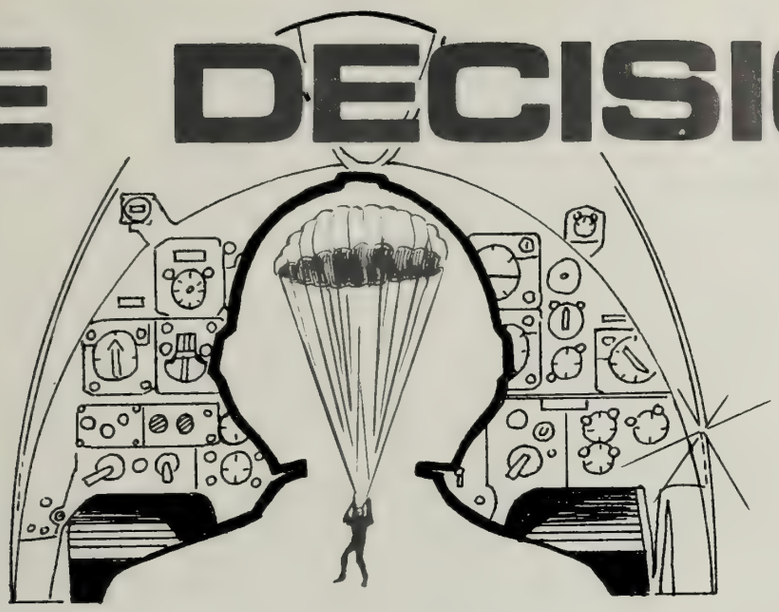
It may not be what you always planned, but a look in almost any crystal ball will indicate that there are more and more simulation devices in your future. ★



The whole purpose of simulators is to make the USAF pilot the best trained pilot possible. While they can never replace the reality of flight, simulators have become a valuable tool in USAF training plans.

LIBRARY U. OF I. URBANA-CHAMPAIGN AERONAUTICS

THE DECISION



LT COL JAMES A. LEARMONTH, Directorate of Aerospace Safety

Over the years, since the advent of the ejection seat, our statistics have shown consistently poor results from emergency egress attempts initiated at altitudes lower than 2000 feet AGL.

From January 1975 through June 1976, we have had 23 attempted ejections at or below 500 feet AGL, resulting in nine fatalities. Technological advances have had little effect it seems in preventing low-altitude ejection fatalities. The greatest successes in preventing low altitude fatalities have been the PSY-WAR efforts directed at the prevention of low altitude attempts. Dash Ones have for years warned us to eject above 10,000 feet when out-of-control and above 2000 feet in controlled flight. These warnings were developed from a statistical analysis of ejection experience and are not representative of the capabilities of the modern escape systems.

Pilots have been lauded for exploits which have saved lives and valuable equipment at great risk to personal safety. Perhaps each of us in the darker recesses of his mind nurtures the Walter Mitty dream of saving the city from catastrophe by staying with his crippled craft until the last second. In the cold light of day, this dream is soon replaced with sound reasoning and the ejection decision now must be when there is no hope of saving the aircraft.

Here are two examples: An F-100 pilot returned his fighter to the field shortly after takeoff with a fire warning light. A chase pilot reported flames from the lower fuselage. As the final approach was established, it became painfully apparent that the airplane wouldn't make it with the failing power available. The pilot persisted in the approach, attempting an afterburner light (unsuccessful), and raising the flaps to one-half. On short final, the pilot ejected and the aircraft crashed on the airfield. The pilot was incapacitated for several months before he was returned to flight status.

On a routine navigation flight, an A-7 started to compressor stall. A precautionary approach to a civilian field proved unsuccessful when the pilot commanded military thrust to arrest the high descent rate on final. The aircraft crashed on the airport. The pilot was saved from certain death when his ejection trajectory carried him into a 60-foot depression in the approach terrain.

In my observation of fighter/trainer accidents in the last couple of years, I've seen what appears to be an increase in last minute ejection attempts. I can only relate this to a failure to recognize the hazard presented until the outcome becomes obvious. Each of us flying an ejection seat equipped aircraft should spend some time with himself thinking through the possible situations that may require him to make the ejection decision. This conscious pre-thought process will, if the situation develops, reinforce your ejection decision.

Notice that I do not demand faithful adherence to the 2000/10,000-foot rules. I would rather you consider them as factors to be used when an ejection decision must be made. Each of us weighs the factors in the decision-making process differently. I would be presumptuous to assume that regardless of the factors at a given situation, we will all eject at 2000 feet AGL. But for me. . . .

When the situation presents itself, recognize it for what it is, then eject early and enjoy the view. ★

About Aborts

CAPTAIN DICK MORROW
116 TFW, GA ANG
DOBBINS AFB GA



Frequently I think we in the flying safety business beat to death the obvious. I remember, for example, sitting through thunderstorm briefings ad nauseam—all just to convince me not to fly into them. Really now! Does anyone try to fly into thunderstorms? Having blundered into one in my brown bar days, I know better. And yet we harp and harp on the obvious danger of thunderstorms.

Lest I be misunderstood I must hasten to say I am not trying to eliminate all thunderstorm briefings. Rather I am using them as an illustration. My point is this. Rather than continually reviewing the obvious, maybe we should poke around under rocks and explore the dark, dusty, mysterious coffin corners. Occasionally we need to wrestle with some gray areas, and help rope off corners before pilots are boxed into them.

My purpose here then is to discuss one of these gray areas, show how I've attempted to tackle it, and to promote discussion. Perhaps from the collective wisdom of USAF pilots we can distill some better guidance. The topic—aborting.

High speed aborts are always dangerous, particularly so, in an aircraft like our venerable F-100 which gobbles up lots of runway getting airborne. On every takeoff the ever present choice looms: Is it now less dangerous to abort or continue takeoff? A knotty problem always. Our F-100 Dash One provides but sketchy help. It's replete with phrases similar to this: "If blank happens and *sufficient* runway or overrun is available, abort the takeoff. If not *feasible* to abort. . . ." That's not much help, especially to new pilots without the gray hairs of Hun experience.

Of course, I realize emergency procedures must be flexible. Every situation is unique. Yet it should be possible to better define when to abort and when to continue.

Looking again to the Dash One we can compute a refusal speed. This tells us how fast we can accelerate and still stop in the remaining distance with or without a drag chute. However, even this is relatively meaningless because we operate from runways with barriers, thereby allowing us to go faster and still stop. So, that still leaves us pretty much in the dark.

My problem then was how to better define when to abort. To start, I had only my own personal opinions, but they needed challenging. Therefore, I began by devising a questionnaire for our pilots. I asked if they would abort in each of many situations. Additionally, I asked how these would change under IFR conditions and provided space for questions, comments, techniques, and opinions. Particular weight was given to answers by IP's and "old heads." Besides soliciting ideas, the questionnaire forced our jocks to think through their own personal abort parameters. Surprisingly, some admitted they'd never considered each abort situation completely and had indeed learned from just this detailed personal analysis.

Next I reviewed data from Norton. Then armed with all this material, plus my own personal ideas, I waded into a flying safety meeting. And did we have a dandy! I refereed a rip roaring good argument. (In fact, we continued over through a second meeting.) Amazingly enough, however, we ended by agreeing on many major areas.

On the next page is a simplified version of the questionnaire with our conclusions.

QUESTIONNAIRE

CONDITIONS: Dobbins AFB, F-100 with full 335 drop tanks, Wt. 36,000 lbs., Temp. 70°, P.A. 1000', Line speed 122 knots at 2500', T.O. 172 knots at 5600', Formation takeoff, VFR day.

WOULD YOU ABORT UNDER THESE CONDITIONS?

THIS LIGHT COMES ON:	*AT LINE SPEED 122 KNOTS*	*AT ROTATION 157 KNOTS*	*AT LIFT OFF 172 KNOTS*
Fire	Yes	Yes	Divided
Engine Overheat	Yes	Yes	Divided
Fuel Valve Fail	Yes	No	No
Boost Pump Inop	Yes	No	No
Anti Skid Off	Divided	No	No
Heat & Vent Overheated	Yes	No	No
Engine Oil Overheated	Yes	Divided	No
Flight System Failure	Yes	Divided	No
Inst AC Power Off	Yes	No	No
AC Generator Off	Yes	No	No
DC Generator Off	Yes	No	No
THIS OCCURS:			
Loud Thump Or Bang	Yes	Yes	No
AB Failure	Yes	Yes	No

NOTES:

1. Many believe we should abort under any of these conditions at line speed to keep a simple, consistent decision technique. Many think anti-skid a legitimate exception, as it is better to continue the mission and return to land and stop a lightweight aircraft.

2. The questionnaire was worded, "This light comes on" purposefully to bring up the problem of false warnings. Also the occurence of transient conditions and the probability of concurrent failure in backup systems were discussed frequently. These problems lead partly to our divided opinions on "engine oil overheated" and "flight system failure."

3. With low overcast skies the "generator off" light changes to an abort decision.

4. At lift off we are divided for fire and overheat. It depends basically upon whether one trusts the ejection seat or barrier more.

5. The "no" answers in both lift off and abort speed decisions are because we agreed the dangers encountered by continuing are less severe than those of a high speed abort. It is not because we want to get airborne with a sick bird!

Nothing revolutionary here—but a good start. At least now we have each forced ourselves to define and decide on our own abort parameters. Probably that's the real key anyway—more important than any group decisions. One must have a plan of action and carry through.

Our decisions here obviously apply only to one specific set of conditions, not to any other base nor any other fighter. But we have tried coming to grips with one of our gray areas. In doing so we have had some interesting fallout. First, our simulator program has been improved with much more knowledgeable and specific abort training. Second, we have identified an aircraft design and Dash One weakness. They are:

1. We need better designed caution and warning systems. Advisory lights indicating abnormalities should trigger either a "Master Caution" (amber) or a separate "Master Warning" (red) light. This would help pilots make those split-second decisions and help eliminate our present confusion.

2. Our present refusal speed is almost worthless. We need a usable, realistic refusal speed which includes barrier systems and some probability of engagement success. This should give us a successful abort probability versus speed and runway remaining for a specific barrier configuration.

In concluding I'd like to challenge other pilots to analyze their abort procedures and techniques. Through the Air Force pilot group we can surely generate better information than we now have. Certainly any crossfeed between units would be helpful, and in particular, we would appreciate hearing from other Hun drivers any opinions on aborting.

Finally, I must restate these tried and true abort rules.

- Practice, practice, practice in the simulator. That's the best way to become proficient at interpreting warnings, assessing airspeed and conditions, making the proper split-second decision, and executing the abort.
- Have a plan for the day. Before taxiing onto the runway decide for that takeoff, based on runway, barrier and weather condition, what will cause you to ground abort. At 170 knots is no time for a mental debate.
- Review the abort procedure just before takeoff. Look at and physically touch all the necessary switches and handles. Crossing the BAK-9 looking for a tailhook button at night takes years off your flying career.
- Don't delay. ★



CAPTAIN PHILIP M. McATEE, Directorate of Aerospace Safety

The PA-23 pilot was enroute home to Texas from Montana, when weather forced him to remain overnight at his first stop.

The next morning he filed VFR for home and departed at 0840 MST. When he didn't arrive at his destination, a search was launched and the wreckage was found the next morning at an elevation of 5000 MSL. Local residents said snow began falling about 0800 the previous day; and by 1000 about two inches had accumulated. The ground visibility was 100 yards while the snowstorm was in progress; but the weather was clear by noon.

The above is typical of accidents involving light aircraft each winter. Along with the winter season come many seasonal hazards which, although they are not new, continue to take lives year after year. Since many of our readers fly general aviation aircraft, we thought it would be beneficial to review the most common major causes of winter accidents.

WEATHER Rapidly changing weather is by far the greatest hazard in winter flying. Weather gets both novices and experts. Don't assume it's just the low time or inexperienced pilot.

Fog and reduced visibility are always major factors. Remember, in winter rapid temperature changes are common. Most of the time the weatherman is right. *Always* get a weather briefing. Know yourself what conditions are likely to produce fog. While enroute, keep up-to-date with latest developments by using your flight service stations. Both enroute and destination weather can change very quickly during

this season. Plan ahead and always have an alternate plan in mind if conditions deteriorate. Never push to get home. If conditions start to go down, land at a suitable field and wait awhile. The weather is bound to improve. Better to be late than to contribute to the scenery.

POOR FLIGHT PLANNING Just plain running out of fuel continues to take its toll. At this time of the year, add an extra reserve of fuel to allow for deviations around weather. Remember, the days are shorter, and headwinds are frequently stronger than forecast. Don't try to stretch your fuel. If conditions change, change your plan. Plan another stop for fuel so you will have enough for any alternative plan you may need. A good rule is to fly VFR with at least the same reserves required for IFR. Never be reluctant to add an unscheduled stop for fuel in order to make certain to have the reserve.

HIGH GUSTY WINDS This common condition is often coupled with icy runways, crosswinds and, for good measure, high snowbanks on each side of the runway. Also, many runways are not plowed to their full width after snowstorms.

The only way to learn how to handle certain conditions is to experience them. But don't wait until there are ice and snow on the runways to practice those crosswind landings. Landing in gusty crosswinds in the winter calls for plenty of practice and precision on the part of the pilot. Practice now, nailing it right down the center of the runway on both takeoffs and landings. And remember that driving through puddles or slush can cause problems, especially for retractable gear airplanes. It is very embarrassing not to be able to retract the gear, or worse, have it not come down.



In winter, weather can rapidly change. Always leave yourself an out.



Each winter hundreds of search and rescue missions are necessary to locate missing aircraft.

CARBURETOR ICE Every time we think that reams have been written about carb ice and that everybody knows about it, we have another accident.

A Cessna 150 pilot was on a cross-country when the engine began running rough and then lost complete power. He never thought of carb heat and was forced to make a forced landing under less than ideal conditions, wiping out the gear.

Carburetor icing is still a major cause of accidents. If you suspect icing, try carb heat. Don't just apply it and shove it right back in. Apply it, see if there is a drop in rpm, and wait a few seconds. The engine may run rough for awhile then clear and regain rpm and smoothness. But check the operating manual and the engine manufacturer's specifications for your aircraft to be sure you apply heat properly.

STRUCTURE ICE Surprisingly, most airframe icing accidents do not occur from in-flight conditions, they are a result of pilots' attempts to take off with frost or ice that accu-

Winter Wisdom continued

mulated on the airframe while it was parked and was not properly cleared. *All* ice and frost should be cleared before flight. Even a very thin layer of frost can change the aerodynamic characteristics of the surfaces and drastically increase stall speed. Snow can be brushed off with a stiff broom or brush; but frequently underneath the snow there is a layer of ice. Since deicing fluid is often difficult to get at smaller airports, during the winter you should anticipate and carry your own. Several companies make small spray containers of aircraft deicer compounds. Each can is usually sufficient for one application necessary to clear a single layer of frost or ice and is available from most fixed base operators. Add a can to your winter gear now.

Airframe ice can also be accumulated after the aircraft has been taxied, as the following accident account shows.

The flight was a Beech 99 scheduled air taxi run with a planned departure of 1500 EST. Due to weather, the flight was late in arriving. Prior to departure the aircraft was deiced. *The passengers boarded and the aircraft taxied at 1615. The weather at the time was overcast indefinite 1200 feet; 1½ miles visibility with ice pellets; light snow and fog; temperature 29 degrees; dew point 27 degrees. Snow had started falling and was accumulating.*



Scenes like this unfortunately become far too common at this time of the year.

Shortly before takeoff, the runway was checked and ½ to ¾ inch of slush was on the runway.

The pilot stated that during takeoff roll the engines appeared normal; and the ice pellets that were on the wing were blown off and the surfaces appeared clean. The takeoff roll was longer than normal with rotation speed 90-95 knots. As the aircraft climbed through 100 feet, airspeed 116-120 knots, stall characteristics became present and loss of aileron control became evident. Full power was maintained; but the stall and control problems became more severe.

The pilot decided to land in a rough field ahead and to the left. He landed with full power and gear down. The aircraft was destroyed, but all survived.

Now what happened can only be surmised, but obviously the stalling speed was greatly increased. Possibly the slush on the runway was thrown up and stuck to the aircraft on takeoff roll. Also, ice can accumulate very quickly on surfaces with those conditions present.

One final thought on winter flying. In recent years several aircraft have gone down; and the people survived the crash only to die from the elements. Always file a flight plan and check in along the route. Carry clothing and a small survival kit suitable for your route of flight. It won't do you much good to be dressed for the beach if you go down in the mountains on the way. A survival kit need not be large or complex to contain enough vital equipment to make the difference. Build yours now! With proper planning and care you can have many hours of safe flying this winter. ★

OPS TOPICS

BLOWN TIRE

The cause of an HH-53C blown tire may have been a combination of low tire pressure and high side loading on the tires during taxi. This combination distorted the tire to the point where it rubbed against the brake bleeder housing. The bleeder cap cut through the tire sidewall and caused a blowout. While maintenance is responsible for correct tire pressures, the pilots are the ones who can use proper taxi speeds and minimize side loading on tires and gear.

THE OTHER LEFT

The B-52 aircrew was at a strange field preparing to return home. During his preflight, the aircraft commander requested that some maintenance stands near the left wing be moved. The stands were moved; but a large power unit was left parked close to the wing tip. The unit required a special tractor to be moved. The maintenance crew agreed to furnish wing walkers; so the pilot did not insist the unit be moved. Once the engines were started and the brakes checked, the pilot, after noting that the right wing area was clear, decided to increase the distance from his left wing to any obstacle by use of crosswind crab. He started to feed in right crab in order to turn right. Unfortunately, right crosswind crab causes the wheels to turn *left*. So before the pilots or the marshallers realized the mistake or could take action, the aircraft's left wing tip struck the power unit.

FORMATION FLAMEOUT

Two T-37s took the active for a formation takeoff. During the takeoff roll the left engine of number 2 flamed out. The crew successfully aborted the takeoff. Maintenance could find no defects in the engine. Since the runway had numerous puddles of water on it, the most probable cause of this flameout was water ingestion. Since number 2 was on the left wing, it is unlikely that the lead aircraft's main gear wheels were the cause. Rather, the nose gear of the number 2 aircraft splashed sufficient water to cause a flameout.

DID YOU KNOW?

Breathing 100% oxygen reduces your tolerance to sustained high-G maneuvering. This phenomenon has been established during experiments in the human centrifuge at Brooks AFB, Texas, where the experimenters reasoned that 100% oxygen would improve G tolerance but found just the opposite to be true. The same thing has been noted by engineering test pilots at Edwards AFB during sustained high-G maneuvering (5 to 8 G's exceeding 10 to 15 seconds) in high performance aircraft. During these conditions, crewmembers breathing 100% oxygen experienced trouble with breathing. They found that efforts to breathe deeply produced continuous coughing, violent enough to cause eye-watering and blurred vision, which essentially incapacitated them as long as the high G's were sustained. The problem went away when the G's were relaxed. Postflight physical exams revealed no lasting effects.

The cause of the problem was traced to the fact that air cells in the lung (the alveolus) collapse under sustained high G's in the absence of a buffering inert gas, such as the nitrogen that is inhaled into the lungs when you are breathing air, but not when you are breathing 100% oxygen.

The message to be gleaned from all this is obvious: If you're feeling rough and must pull high, sustained G's, don't go on 100% oxygen. You'll feel rougher.—Courtesy F-5 Technical Digest

OPS TOPICS

WHAT'S MY WHAT?

A recent air traffic procedure change is to provide the pilot with *circling* Minimum Descent Altitude (MDA) when a surveillance radar (ASR) approach will terminate in a circling approach. The pilot is expected to announce his aircraft circling approach category in such cases. If not, the controller has to ask. So, know your aircraft circling approach category. You could be tested on that subject on short final; that is not the time to ask for the question to be clarified.

STAYING ALERT

The Canadians put it this way: The captain and first officer received their clearance for a short segment of their route, one which they'd flown many times. There was an altitude restriction for the initial climb to remain below inbound aircraft. The 4,000-ft restriction was acknowledged, but the captain set 6,000 on his altitude alert system. The copilot did not notice the mistake. The result—two aircraft too close.

Aero medics say that when senses are not being continually stimulated, boredom will set in. In such a state a pilot (or anyone else) can do something he is not even thinking of doing and never intended to do. This is a human frailty.

The fact that the captain set the wrong altitude and that the copilot missed it, indicated a low level of stimulation for both crewmembers, with the attendant low level of alertness. This human quirk is a factor in many accidents and incidents. To reduce inattentiveness, get in the habit of continually being on top of cockpit developments, even when nothing noteworthy seems to be happening. This may appear to be unnecessary, but the mind needs stimulation to remain alert. That is really tailoring behavior to make up for a major human limitation everyone is born with.—Courtesy Flight Safety Foundation Accident Prevention Bulletin

CABLE BOUNCE

Rolling over barrier cables on landing is still causing problems. A C-130 lost both lower UHF radio antennas when the arresting cable bounced up and struck the aircraft. It is not always possible to avoid the arresting gear. In the mishap above, the cable is 3500 feet from the approach end of the runway. But where possible, you should plan to land past the cable or be slowed down as much as possible before crossing it.

IT PAYS TO BE READY

While on a local training flight, the UH-1 tail rotor servo pressure return line ruptured causing hydraulic failure. Fortunately, this crew was well prepared and successfully completed a hydraulics off landing at a nearby civilian airport.

COCKPIT DAMAGE

When the rear seat pilot climbed into the cockpit of the T-38 he stowed his helmet bag under the seat. Normally this would be no problem. However, the pilot forgot that his flashlight was still in the bag. So, after engine start when he lowered his seat, the flashlight was forced into the floor making a hole 4 inches in diameter. The pilot had been briefed by the IP not to place hard objects under the seat, but had forgotten about the flashlight.

OPS TOPICS

WIRE MISS

The UH-1 was on final approach to the landing zone when the crew saw some wires about 10 feet in front of the helicopter. At this time the aircraft was at about 20 feet AGL. The crew was forced to use rapid application of power and aft cyclic to avoid the wires. The crew did not notice the torque reading during this time; but the low rpm warning did come on. After landing, the aircraft was inspected for overtorque.

JET BLAST

Jet blast has caused pilots some embarrassment lately. In the September Ops Topics we told of the RC-135 that sandblasted some cars. This month we have a C-5 substituting for a wind tunnel. The C-5 had landed at a civil field for a cargo mission. After engine start, the C-5 began to taxi. However, the crew misinterpreted their taxi clearance and proceeded to the wrong taxiway. When they realized their error, the pilots increased power on engines one and two to aid in making the hard turn necessary. During this turn, the blast from the engines overturned a Cessna 150 parked 280 feet behind the C-5. Test data indicates that with an EPR of 1.64 the blast velocity from a C-5 engine is 50 mph at 290 feet. Since the Cessna 150 was not tied down, this blast was more than sufficient to overturn it. Obviously, blast effects must be a major consideration in crew planning, particularly in the case of larger, more powerful engines.

LOOSE SCREWS

As the A-7 pilot unfastened his parachute harness after a flight, he noticed a loose screw on the back of the CRU-60/P mounting bracket. When he tightened this screw he discovered two others missing. The screws were found in the cockpit. The unit made an inspection of all parachute harnesses and found three more harnesses with loose screws.

"EYE" FR

Lest we become too complacent in our positive control, all IFR cocoons, a C-141 was cruising at FL 310, as cleared, when the crew noticed a 707 coaltitude and going the opposite direction at their 12 o'clock position. After taking evasive action, the crew found out that air traffic control *thought* that the C-141 was at FL 350.

PIGEON HUNTING

Just before the C-123 touched down, the crew saw a flock of birds in the touchdown zone. It was too late to avoid them, and the aircraft flew into the flock on touchdown. The aircraft sustained only minor damage but the impack killed approximately 250 pigeons.

CLEARING AGAIN

Here are some more very good reasons for clearing, especially at lower altitudes.

- A T-37 was making a radar monitored letdown to an auxiliary field when the aircraft had a near miss with a civilian light twin flying VFR without transponder.
- A B-52 almost hit a small Cessna aircraft while making a low level bomb run on a published OB route.
- A flight of four F-4's was forced to discontinue their approaches because a light aircraft flew unannounced through the airport traffic area. ★



THERE ARE

MAJOR JACK SPEY
475 ABW

When was the last time you landed at Taipei, Hong Kong, or Manila? In all probability, for most of us it was sometime ago. Command directives require aircraft commanders to have route checks into such exotic places. While they may be qualified by regulation, unfamiliarity due to time may cause a feeling of insecurity to develop. Overembellished war stories may spring to mind about instrument approaches into some overseas airports. Wild tales have been told about the dragons in the hills surrounding Taipei. Pilots still talk of their first wild ride through the famous Cheung Chau Stonecutters ADF to the Hong Kong curve for Runway 13. Most of these stories exist because pilots were unfamiliar with what to expect and unaccustomed to the sounds.

Assuming our route check was some time ago or we find ourself as AC for the first time due to crew availability, let's examine a few ways in which we can give ourselves a mental route check.

Our FLIP contain more than enough information, but it is important to try to develop a possible scenario or mental picture of what to expect.

First, examine the Low Altitude Instrument Approach Procedures for the airport and note the runway having the ILS approach. In most cases this will be the preferential runway to effect the rapid flow of traffic unless surface wind becomes a major factor. Again using the low altitude approach book, note the IAF altitude (High Station Outbound) for the ILS approach. Quite often, this will be the downwind leg Minimum Vectoring Altitude (MVA). Now note the procedure turn altitude. This will often be the Base Leg MVA while on vectors to the final approach course.

Check the Glide Path Intercept (GPI) altitude. If this figure is not in 500 ft increments (2500 ft—3000 ft, etc), round it off to the next highest 500 ft increment. (For example: 2200 ft=2500 ft) This will often be the dogleg altitude while on radar vectors. The IAF and procedure turn altitudes depicted on a low altitude ILS approach chart are often the Minimum Vectoring Altitudes (MVA) for the downwind and base leg respectively, assuming that optimum pattern size has been maintained by Approach Control. The final descent directed by Approach Control will usually be on a dogleg to the final approach course and will be the GPI altitude rounded off to the next highest 500 ft increment.

By investigation, we are able to anticipate the pattern altitudes to expect upon arrival at a strange field. Now let's see if it is possible to determine the direction of traffic for the runway. Again, referring to the Low Altitude ILS plate, check to see on which side of the localizer the procedure turn is located. Now let's check the sector altitudes. Are they the same or lower on the corresponding side? Examine the remaining charts for the airport. If the airport has a non-precision approach for the same runway, see if the procedure turns are located on the same side of the localizer as the procedure turn for the ILS. Then note the direction of the missed approach courses for all approaches. Normally all maneuvering to final approach on a non-precision approach or ILS/PAR will be done on the side of the airport which has the lowest terrain. The downwind leg, for radar vectors, will normally be placed on that side. Again, by investigation we can anticipate the direction of traffic.

Now let's have someone else give us a route check or a refresher ride.

"Clipper 843, this is Taipei Control. Descend and maintain one zero thousand, altimeter 29.78. Report 30 miles NE of Taipei VOR."

"Clipper 843, wilco. Leaving flight level three one zero for one zero thousand, altimeter 29.78."

"Taipei, this is Clipper 843. Level one zero thousand, 30 miles Northeast, Taipei VORTAC."

"Clipper 843, Taipei. Roger. Squawk zero four one six and Ident. Contact Taipei Approach on 125.1."

The sounds of international airports can create problems for the unfamiliar pilot. Commercial airline pilots are more familiar with them because they frequent the same airports. However, for many of us, the names of navigation fixes are strange and sometimes difficult to pronounce, and controllers' instructions are more difficult to understand due to accented English. Our confidence may even be shaken when the voice of the controller is heavily accented, or we sense a lack of command in his second language. But remember, he knows his job, and by listening to the instructions given to the aircraft preceding

NO DRAGONS

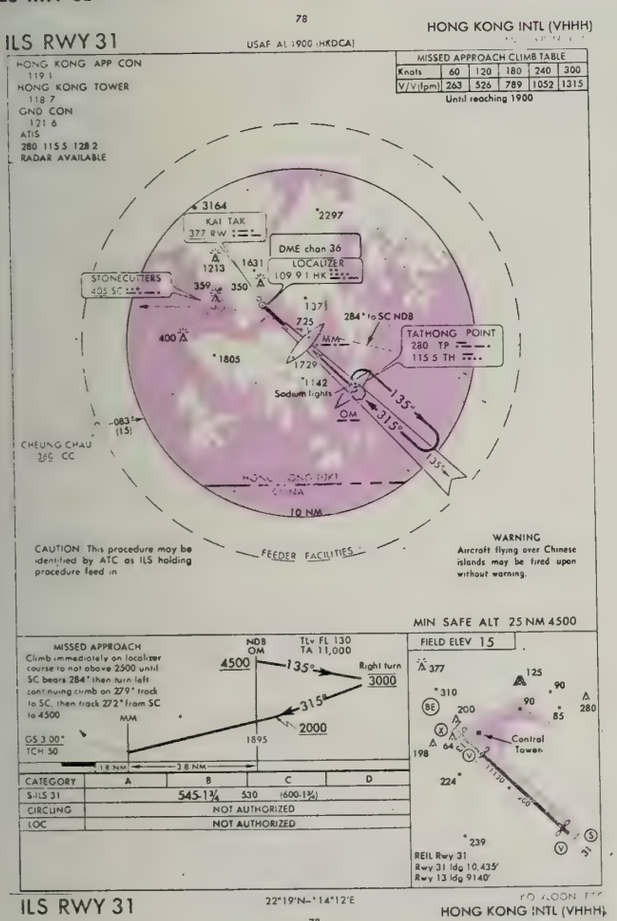


us, in addition to ATIS, we can familiarize ourselves with the sounds, the names of reporting points, controllers' accented voices, and procedures to expect when it's our turn to start down "the chute."

Note the frequency sequence. (Some in use may not be in the En-route Supplement.) By listening to the instructions given to the commercial traffic preceding us, we can receive a free route check and also monitor for possible conflicts. This, of course, means utilizing VHF for primary communications with ARTC and Approach Control, or by obtaining and monitoring both the UHF and VHF frequency used by that controller. Commercial and general aviation utilize VHF for air traffic control exclusively. If the military pilot is using UHF only for primary communication, he will be hearing less than half the action and losing the benefit of hearing, and thus becoming familiar with, the sounds and the procedures.

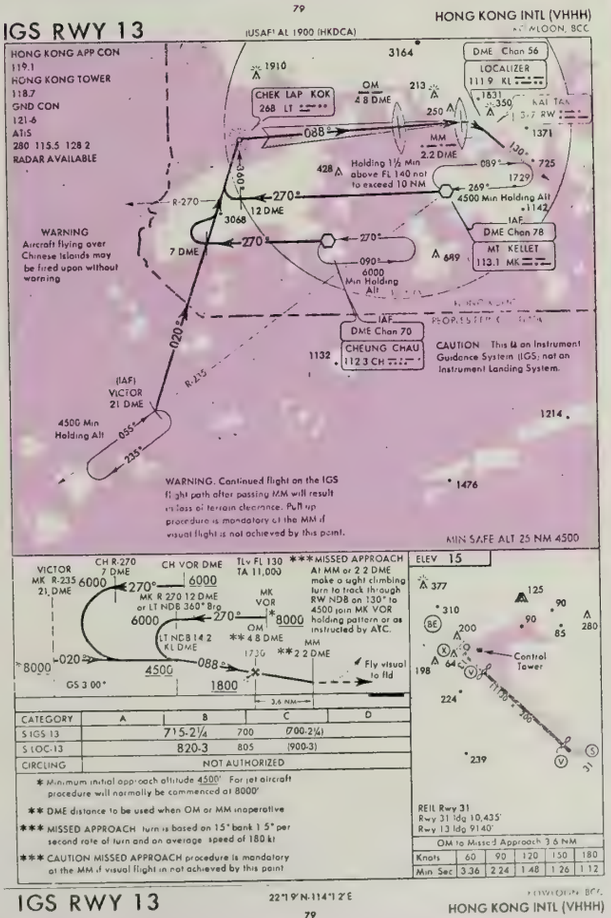
Both at home and abroad, careful examination of the Low Altitude Instrument Approach Procedures and STAR charts can provide a clue to the MVA's and direction of traffic to the unfamiliar airport. Armed with this information, and ATIS, a little extra attention to the preceding traffic can acquaint us with the unfamiliar and help kill the dragons in our minds. ★

ILS RWY 31

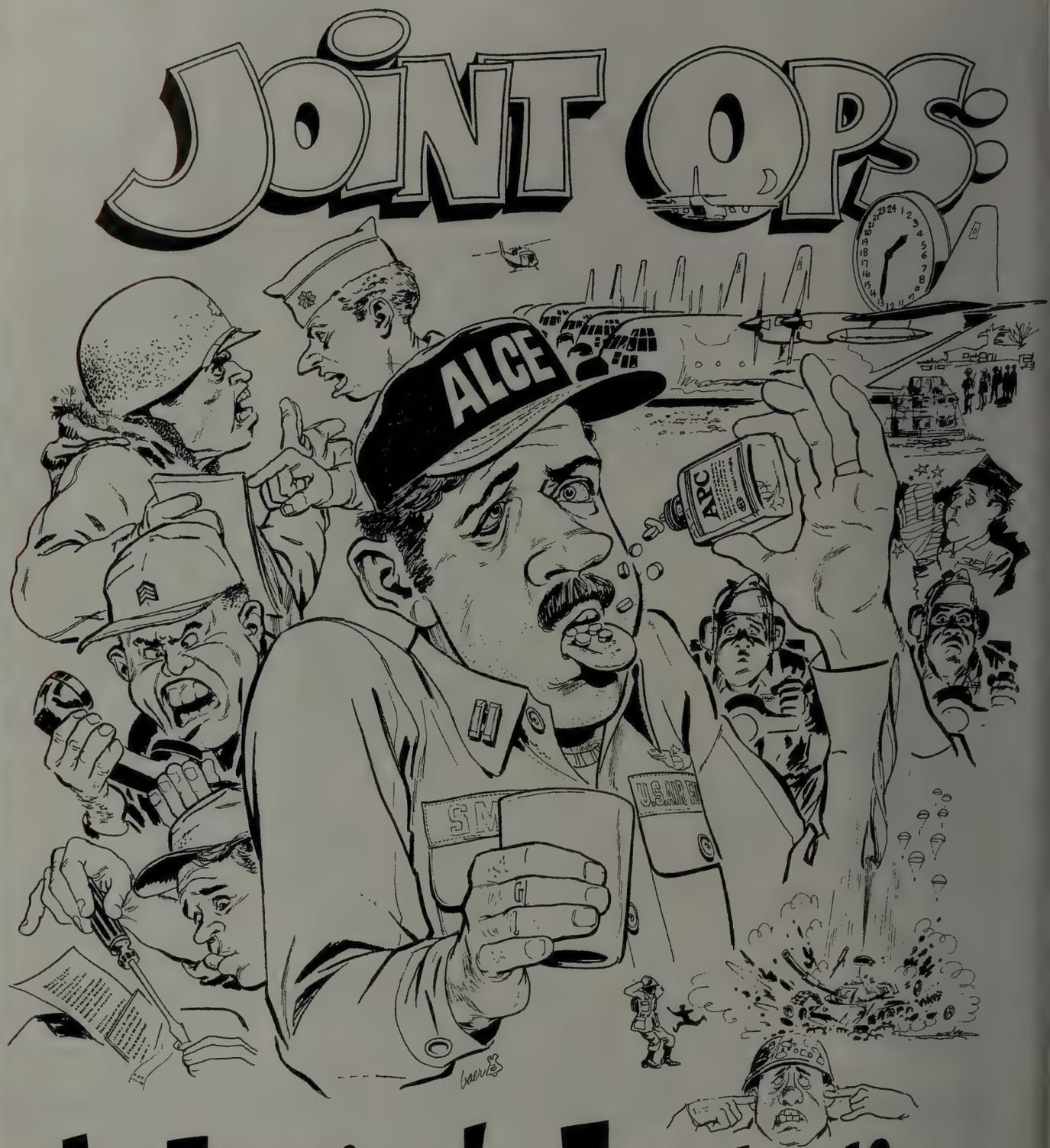


This is a standard ILS but study, like the article suggests, would be necessary for a missed approach.

IGS RWY 13



Without some prior study, an attempt to fly this approach could easily become a nightmare. Notice this is an IGS (Instrument Guidance System) not ILS.



An Exercise In Frustration

CAPT J. T. REYNOLDS, Dyess AFB TX

Like most MAC pilots, especially those of us who drive Herky's for a living, I have participated in seemingly countless Army/Air Force joint training exercises. The frustrations experienced by airlift crews when working in and out of various ALCE's at short dirt runways are awesome. For you fighter jocks, the ALCE (Airlift Control Element) is airlift's answer to the Tactical Air Control Party (TACP). Yes, we actually land our air machines in those forward battle areas while you guys fly around and strafe trees. Let me cite a couple of examples of the kind of frustrations that can lead to a real case of accident proneness during joint exercises.

WEIRD HOURS: The Army, to my knowledge, has never asked to have a man or piece of equipment moved during the hours of daylight. No doubt it is a tactic carried over from the "attack at the stroke of dawn" days. Whatever the reason, airlifters seldom see the light of day during a joint exercise. If they do it is while enroute to the Q's after a long night of flying.

FORMAL AIRLIFT BRIEFINGS: A jointly conceived plan which when combined with the weird hours concept (see above) can thoroughly confuse an aircrew as to when, where, and how they are to go, regardless of how clear it may have seemed before the briefing started. The confusion generated during a formal briefing is awe-inspiring. If it is resolved at all, it is resolved at the INFORMAL AIRLIFT BRIEFING: a discussion which immediately follows the formal briefing. Each aircrew usually has its own plan for determining the correct interpretation of the formal briefing. They argue with the briefing officer until they decide what they are really going to do.

Of course frustrations don't exist only at the formal and informal briefings. In fact, they often increase in number and complexity when the crew reaches the aircraft. Here's how it looks. We reach the



aircraft late because the crew bus had to follow a whole bunch of marching Army troops at least a mile down a narrow road. When we do arrive at the aircraft, the load is on backwards, but it will still work out because we have to go to the spare anyway. After we have quickly preflighted the spare, the ground power cart runs out of gas 3 minutes before start engine time. Second element lead aborts at taxi time and number two (the one in front of us) can't get his attitude gyro to erect. Since I didn't talk to the aircrew of the aircraft now preceding us, I don't know exactly what to expect, but in true airlift tradition, I'll muddle through somehow.

So we launch, hoping the guy I've picked to follow is the correct one and knows where he is going. However, my Station Keeping Equipment (SKE), the computerized black box that allows us to fly and drop equipment and troops in formation from a thousand feet AGL when the ceiling is at 200 feet, and the tops are somewhere beyond our cruise ceiling, has just picked up three aircraft at two o'clock that aren't supposed to be there and two at 10 o'clock that are. With a flip of the old coin and a stiff arm to the throttles, we are now on somebody's tail. I hope he's going where we're going.

Many of us have experienced such predicaments and most have been able to cope with them. Some of us have even devised our own safety slogans. "Don't fly at night, in the weather, or fool with the red guarded switches," or "Black boxes work great when used as VFR backups" are typical examples.

Having just air dropped the 30,000 pound Army tank right in the middle of the drop zone, we head back to the 2800 foot landing strip. I guess it frustrates us a little that the chutes streamered and the tank recovery team will be digging in the sand for a week to get that beauty out, but now comes the real frustration. After landing, we troop into the ALCE to find out what dangers await us for our next launch. Aircrews hate ALCE's. They represent the frustration capital of the battlefront. And now comes the biggest shaft of all times; ME, an ALCE flight commander! Not since survival school have I worn those *green fatigues* and never



have I worn them starched. Not on your life, ol' buddy—the other half of the bucket of worms.

Here I am on day one located on a very remote edge of an Army airstrip some 30 miles from the nearest motel sanctuary. Wearing my "greenies" and standing in front of a sign that says "ALCE." We quickly discover that the day and a half preparation time we allowed for setting up is not nearly enough. Much valuable time is consumed in simply becoming minimally familiar with Army operations.

When the first of 30 or so C-130/141 missions taxis on to our newly marked off ramp, we are still busily installing AUTOVON lines, secure radios, land-line radios, antennas, etc. Some of the aircraft are arriving earlier than expected and some aren't expected at all. A few of the crews seem a bit put out when we cannot approve early departures or provide information about the exact nature of their loads. As of yet we have not found the Army dude who knows all the goodies about load information. Not only are we struggling with our internal functions, but now we discover that our only link with the outside world, our teletype, is all fouled up.

Each ALCE unit is equipped with an AN/UYA-7 teletype that is linked with the exercise TACC/ALCC as well as with all other participating ALCE's. This HF teletype link provides us with all data on incoming and outgoing aircraft and loads. We begin to seek a cure for whatever ails the machine but meantime we are up to our armpits in airplanes.

Some upstream ALCE's are approving early departures: We can't. As we advise the aircrews via radio that ALCC is not approving early goes from our field, each aircraft commander (or designated delegation) comes storming into the 10 foot square ALCE trailer demanding an explanation. Meanwhile, as we field the harassments and insults of the crews, we press on trying to ensure that the proper loads are being loaded on the proper aircraft. Of course, I realize there is no way for the flight crews to appreciate what all goes on within the little olive-drab cubical. To them there could be no possible excuse for an ALCE troop not to be able to honor such a simple request as one or two AUTOVON calls. All too often there simply is not time and the crews stalk out frustrated and sick at the thought of having to finish off a picked over, rapidly aging flight lunch while sitting in the shade provided by the wing of a sick Herky.

Other seemingly simple deviations continually snowball into heartburn situations. Because we have no maintenance or servicing facilities, short notice requirements for any maintenance problems become major projects themselves. With each tense situation, frustrations eventually surface. It plainly would not be possible to describe all of the many similar instances which crop up during a "highly successful joint operation in which



spite of countless frustrations and numerous blems, the job gets done safely and effectively ough the hard work of professionals on both







all training objectives were met."

So, what lessons do I learn from a journey into the land of gas powered generators and "port-a-potties?" The most obvious lesson is that I will be somewhere else the next time the ALCE is looking for volunteers. Just joking, of course?! The most important thing that impressed me is how often I have flown in and out of ALCE's expecting that small team of men to be able to support me the way the command post at the home drome does. A joint operation on unfamiliar turf is difficult at best. The ALCE team coordinates on a minute-by-minute basis with numerous command and staff elements. The local Army units are most interested in airlift schedules. The big boys at TACC/ALCC are busy pumping birds into the system; weaving a web of airlifters throughout the theater on a scheduled and immediate request basis. The aircrews depend on the ALCE team for numerous items from providing adequate taxi clearances on inadequate ramps to directing the way to the nearest place to get a warm meal or quick snooze.

The old cliché about safety being everybody's business is especially true in a joint operation. Frustration over an ever growing sequence of little things can lead an aircrew into an accident. I had always figured that frustration was just one of those things present in flying (like bad coffee and air-sick navigators) that you have to accept and learn to live with.

As I worked in the ALCE I could identify many who were tired and frustrated. Weariness and frustration, like fuel and oxygen, can be a deadly combination to the crew that has given up on maintenance and headed for the billeting office only to be informed that the crew chief has found the proper engine stand and should be finished in time for the crew to pick up the last hop on the frag.

I have exaggerated here and there in the interest of humor and to make a point, but I am confident that even fighter pilots and Army "grunts" get frustrated. Even so, the job must continue to get done safely and effectively and this requires people who are professional and alert to pitfalls that lure a crew into disaster. In this year of emphasis on readiness, are we ready? ★

ABOUT THE AUTHOR

A native of Illinois, Captain Reynolds attended Southern Illinois University where he received B.A. and M.S. degrees. He was commissioned into the Air Force via OTS in 1969. First tour of duty after graduation from UPT was as a T-37 instructor pilot at Vance AFB, OK. Upon completion of the ATC assignment in 1974, he transitioned to C-130's at Dyess AFB, TX and was tactically qualified as an aircraft commander. He has since attended the USAF Flying Safety Officers' Course at the University of Southern California and now serves as a wing flying safety officer.

Photographs by
Lt William Provance
Cartoons by
SSgt Robert Kolinsky



when it's REELEY cold

FIRST LIEUTENANT DON PIERSON
Elmendorf AFB, Alaska

You hear a lot of old sayings in the Arctic.

"It's cold out there" is probably the most frequently said "old saying" in the Arctic. Since cold is what the Arctic is all about it isn't surprising that people say that a lot.

Cold does nasty things to people and airplanes.

When the temperature gets down to zero most old sayings have undertones of *reverbratto* caused by shivering. When it gets down to −20 the old sayings are accompanied by loud chattering and laced with adjectives like "reeley cold", "frozen solid", "cold soaked", and references to left parts of witches' anatomies. When it gets down to −40, airplanes and people don't operate very well. Seals get brittle, and leak, valves stick, fingers, toes, and noses get frostbite quickly.

That brings up another famous old saying on any flight line anywhere in the Arctic, "Put some heat on it." It's amazing what the hot air machine, the Herman Nelson, can do to stop leaks, free valves, and put feeling back into toes and fingertips.

In addition to normal operations, you have got to consider what the cold can do to the macinery. Operating hydraulic systems in cold weather can cause seals to blow. Slowly cycling controls or brakes will warm the fluid and the system to a more forgiving temperature. Cold temperatures can also affect the flight characteristics of planes. Everybody knows planes get off the ground quicker on cool days. You can easily over torque on cold days. The high torque will also increase minimum control speeds.

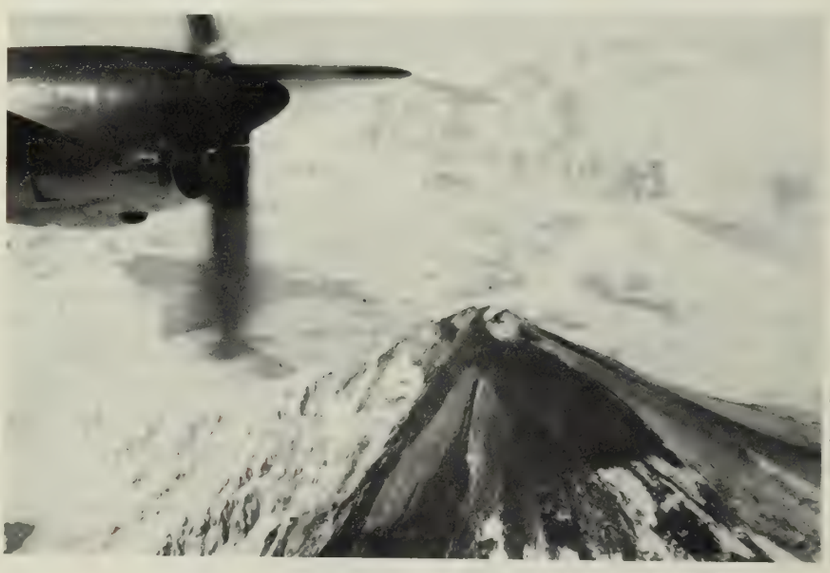


Photo by Capt Don Bowers

It is cold outside.

Something that doesn't affect equipment but has profound affect on people is windchill. How about the old saying, "Jeez, that wind is cold." It's true concerning people. Twenty degrees below zero is the same for equipment whether the wind is blowing or not. Thirty knots of wind added to that twenty below can change an uncomfortable but safe temperature to a situation that will freeze exposed flesh in 30 seconds. If you're in the cold conditions, staying out of the wind is an important consideration.

Every time people operate in the cold somebody is going to coin that old phrase, "These boots aren't very warm." Trudging around Base Ops in muckluks, with sweaty feet is a hassle, but it won't hurt you. You have got to anticipate the worst conditions you'll be in and wear or take what will be required.

If you fly in the fall, you will experience termination dust. Later on the same stuff will be called snow but the sourdoughs call it termination dust because it

terminates summer. Whatever it's called, it's a first class hazard. Low visibilities, whiteouts, a white ground blending with white skies, false horizons, or no ground references can make instrument flying the only game in town.

The Northern Lights can be an added optical illusion. A sheet of green light makes a beautiful picture but when it dances around at a constant 30° angle it tends to appear to be vertical, and you have an instant case of the leans.

Ice is a continual problem in arctic operations. It can freeze on the landing gear doors after retraction and prevent subsequent lowering. That would be a hard one to explain, especially since normal procedure is to recycle the gear when operating in icy or slushy conditions.



Photo by Capt Don Bowers

With these temperatures everything is more difficult. Men and machinery both work slower.



Photo by Capt Don Bowers

How's this for runway slope? Landing could be a pretty slick experience.

The biggest problem isn't ice that's too sticky. Generally it's too slick. Arctic locations can get too slippery to taxi or take off. You'll hear RCR readings so low you'll wish they were reported wrong. You may not be able to keep from sliding with idle thrust. Or you could slide out of ice chocks, sideways parked on a slant. Any operations on ice better have plenty of room for an added pucker factor.



USAF Photo

Another vast assortment of old sayings deals with short daylight periods and long periods of darkness. "Where's the sun been for the last month; the days sure are shorter these days." "It must be lunchtime; the sun is setting", and "it's too dark to get anything done", are often heard in the Arctic.

Cold weather operations need some special considerations. Some other old sayings apply when operating in this "unique environment." There is no substitute for sound judgment. Anticipating and preparing for the worst situation will prevent the Arctic hazards from biting you. ★



water

SSGT CHARLES R. TEAGARDEN
Programs and Current Operations Branch
3636 Combat Crew Training Wing
Fairchild AFB WA

Next to air, what is probably the most important element in the world? Would you believe water? But if I asked, "Why is water important?" or "Where could you procure it if you were in a survival situation?" a lot of you probably couldn't answer. This article will cover the importance of water, water related problems, and water sources, to a depth that should enable you to answer these questions in any survival situation.

Of all the substances in the world, potable water is probably the most universally important, and in a survival situation, the need for safe water is acute. People who have returned from survival episodes have indicated that water, thirst and dehydration were problems that had to be constantly coped with.

WATER INTAKE AND DEHYDRATION: In hot areas of the world, or when you're working hard, a gallon of water a day may be needed just to maintain normal efficiency. As a general rule, your body requires a minimum of two quarts per day to remain hydrated, an amount of water not complicated by food intake or sickness. Add these factors and your requirements rise dramatically.

The thirst sensation alone is not an indication of the amount of water your body needs. If your mind is preoccupied with other survival problems, the thirst sensation could be suppressed and little by little you would dehydrate. Dehydration is a problem which occurs when water intake is less than water output or utilization. Signs and symptoms of dehydration are thirst, sleepiness, vague discomfort, dizziness, headaches and, eventually, delirium, spasticity and dim vision. Only water, in some potable form, will prevent and reverse dehydration. Your best plan of action in a survival situation would be to drink plenty of water anytime and anywhere you can.

When water is limited, don't ration it! The reason is, if you do not drink enough water to overcome your water debt, it is unlikely that the water you do drink will do you any good. Once dehydration starts, it takes longer and more fluid to reverse the process. The best rule to follow is to *ration your sweat, not your water.*

WATER UTILIZATION: It is also important to understand some of the ways that your body uses water so that you can increase consumption accordingly.

First, all the chemical activities within your body occur in solution. Secondly, evaporation, cooling and perspiration help maintain optimum temperature of the body at approximately 98.6 degrees. Water is also used in the removal of the toxic body waste. During food metabolism this waste increases. As the waste increases, it causes a need for more water to remove the waste, and still more water to replace the loss. This is the reason why the need for water supersedes the need for food. A good rule to follow is to *adjust your food intake according to your water intake, not vice versa.*

IMPURE WATER: Though drinking large quantities of water has been stressed, there is a stipulation: purify your water before consumption. (Of course, there are some situations where this would not be practical or possible.) One of the worst hazards in a survival situation is water borne diseases spread by untreated water. Some of these are typhoid, paratyphoid fever, bacillary dysentery, cholera, infectious hepatitis, schistosomiasis, and amoebic dysentery. Impure water may also contain leeches and flukes. These parasites can cause painful and even fatal diseases. Therefore, the rule *purify all water.*

PURIFICATION: There are two ways in which water can be purified: boiling and chemical means. Boiling as a means of purification would be utilized in most basic survival situations. This method should also be utilized in a PW situation, if possible. The rule is to boil water for one minute at sea level and an additional minute for each thousand feet in elevation. If the elevation is unknown or if you suspect the water may be extremely contaminated boil for approximately 10 minutes. The water will probably be flat or bitter tasting after boiling, but some taste may be put in by aerating the water (pouring the water from one container to another). Chemical purification is normally accomplished in a couple of ways. The disinfectant most often used is chlorine, which comes in a small kit (used by Army personnel). The other method, the one you will probably have access to, is iodine. The chlorine kit and iodine tablets have instructions with them pertinent to their use. Liquid iodine, found in first aid kits, can also be used; add eight drops of iodine to a quart of water, stir or shake, and let stand for 10 minutes before drinking. You may want to include some more iodine in your own personal survival kit.

If you have no means or methods of purifying or obtaining fresh water, at least filter your water before consumption. Water can be filtered by digging a seepage hole a few feet from the edge of a water source. Allow the water to seep in and the mud to settle. Clothing can also be used to filter water.

There are some situations where it is not possible or feasible to purify water. In an escape and evasion situation, one of the things we recommend is that, when the time and situation permit, drink some water. Reports from Southeast Asia indicated that thirst was one of the first things the evader was confronted with but purifying water was impractical. Drinking some water immediately will give you time to think about what you are doing and what to do next. It will also aid in helping to control shock, fear and panic. In desert areas of the world (or anywhere else where water may be limited) you do not want to waste it. Boiling will evaporate large quantities of water so if large quantities are available, boiling may prove feasible. If not, utilize chemical treatment.

WATER SOURCES: In any survival situation you should start searching for water immediately. But where to locate it could pose a problem. Here are three facts to consider: (1) water seeks the lowest point by the easiest path, (2) plants and animals need it, (3) it's in the atmosphere. Seeking lower elevations could reveal water—most likely open bodies of water (lakes, streams, rivers). If you find water, drink your fill anytime and anywhere you can. If a dry stream, lake or riverbed is found, don't give up. Dry water beds often yield water underground in the lower depressions or near green vegetation. So dig, and if water is to be found, it will be within the first four feet. On river and stream beds, try digging on the outside bends.



Dry water beds often yield water in lower depressions. Try digging on the outside bends near green vegetation.

Wells are the main source of water in desert regions. The wells are normally quite deep and a rope would be needed to get the water. Natural tanks and cisterns are other sources of water which may fill during or after rains. So check at the base of cliffs and depressions in rocky ground.

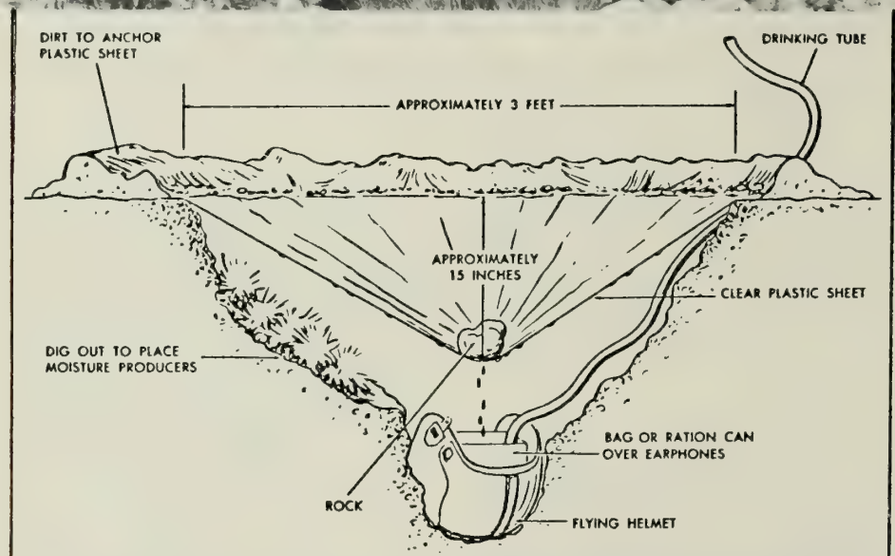


Natural tanks and cisterns are other sources of water which may fill during or after rains. Check at the base of cliffs and depressions in rocky ground.

Green vegetation may yield water but not without work. For example, the barrel cactus, native to the Southwestern United States, contains a fluid which may be obtained by removing the top and smashing the pulp. Vines and trees in tropical regions may be tapped as a source of water. The water from these vines and trees should be pure. If it's sappy, extremely discolored, or tastes bad, discard the water. Other plant water sources include green coconuts, banana plants and sago palms. For their full utilization, see AFM 64-5.

Atmospheric moisture (rain, dew, condensation) is a source of water. Rain need merely be caught in a container. The dew found in early morning can be absorbed by using a cloth and then squeezing it into a container. Solar stills can produce some water, but some notes need to be mentioned. First, a still will not normally create enough water to keep a man alive indefinitely. Second, they need sunlight, but on your side is the fact that they can make water where there is none otherwise available and they can make pota-





Dig a bowl-shaped hole in the soil about 40 inches in diameter and 20 inches deep. Add a smaller, deeper sump in the center bottom of the hole to accommodate the container. If polluted waters, such as body waste, are to be purified, a small trough can be dug around the side of the hole about half way down from the top. The trough insures that the soil wetted by the polluted water will be exposed to the sunlight and at the same time that the polluted water is prevented from running down around or into the container. If plant material is to be used, line the sides of the hole with pieces of the plant or its fleshy stems and leaves. Place the plastic film over the hole and put a little soil on its edges to hold it in place. Place a rock no larger than your fist in the center of the plastic and lower the plastic until it is about 15 inches below ground level. The plastic will now have the shape of a cone.

CAUTION
Make sure the plastic cone does not touch the earth anywhere causing loss of water.

Put more soil on the plastic around the rim of the hole to hold the cone securely in place and to prevent water vapor losses. Straighten the plastic to form a neat cone with an angle of about 30 degrees so that the water drops will run down and fall into the container in the bottom of the hole. It takes about one hour for the air to become saturated and start condensing on the underside of the plastic cone.

ble water from an otherwise non-potable source. (See picture number 3 for description of the still construction).

Snow and ice may be utilized as a water source, but you should melt them to obtain the water. Do not eat snow or ice raw, because the cold will lower your core temperature, thus requiring the body to produce more heat. This could eventually lead to dehydration even though you are taking moisture in. Ice will yield more water than snow per volume but it also requires more heat to melt. Also, use only pure ice (salt free), which is recognized as being clear to dark blue. Salty ice will be grayish in color. Snow must also be salt free.

NON-POTABLE SOURCES OF FLUIDS: Raw sea water should never be used in part, mixing with fresh, or whole as a source of drinking water. It will not satisfy your thirst and will increase dehydration.

The blood and juices of animals and fish are not sources of water but they may serve as a salt substitute or bait for catching other animals. Never drink urine as a source of water.

The following is a list of rules you should remember and follow in a survival situation:

1. Start looking for water immediately.

2. Drink plenty of water anytime and anywhere you can.

3. Purify your water.

4. Ration your sweat not your water.

5. Adjust food intake according to water intake.

The key to water procurement and utilization is preparation. Knowing where and how to find water, how to filter it and what to use as a water substitute, along with survival training and premission briefings, are the necessary foundation. ★

THE IFC APPROACH

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

Even in today's radar environment, Air Traffic Control (ATC) still issues cruise clearances. What is a cruise clearance? What are the pilot procedures to be complied with?

A cruise clearance is an ATC clearance which authorizes a pilot to fly at any altitude from the minimum IFR altitude up to and including the altitude specified in the clearance. You may also level off at any intermediate altitude within the block of altitudes.

Climb and descent within the block of altitudes, between the MEA/MOCA and the cruise altitude specified in the clearance, may be made at your discretion without advising ATC. However, once you start descent and report leaving an altitude in the block of altitudes authorized, you may not return to that altitude without an additional ATC clearance. An example of the controller's phraseology would be: "POST 11, CRUISE 5000."

Q: Is a cruise clearance a clearance for an approach?

A. When an airport has a published instrument approach procedure, a cruise clearance is approval to make a published approach at the destination airport. However, if the destination airport does not have a published approach procedure, a cruise clearance is not authorization to descend below the applicable MEA/MOCA in IFR conditions. Also, in cases where no instrument approach is available, a cruise clearance provides search and rescue protection until the IFR flight plan is closed. In the situation where no published approach is available, be sure to close your flight plan as soon as possible after landing or, if a safe landing is assured, you may close your flight plan while airborne.

Q. Can a cruise clearance be issued while flying on an unpublished route, i.e., one with no minimum altitude depicted?

A. Yes. ATC can issue a cruise clearance to an aircraft when it is on either a published or unpublished route. When a cruise clearance is issued via an unpublished route, the ATC controller will issue a crossing altitude to ensure adequate terrain clearance until the aircraft reaches a fix, point, or route where minimum altitude information is published. EXAMPLE: "POST 11, CROSS SAN ANTONIO ZERO ONE ZERO RADIAL, TWO THREE MILE FIX AT OR ABOVE EIGHT THOUSAND, CRUISE ONE ZERO THOUSAND." The crossing altitude specified in the clearance will ensure minimum IFR obstruction clearance until the aircraft is established on a published route or segment of an instrument approach procedure.

STAGE III RADAR SERVICE

With the advent of Stage III Radar Service at many Air Force bases, some pilots have complained of experiencing delays. Since one of the main purposes of Stage III is to provide radar sequencing and separation to all participating aircraft, you may experience some delay. However, the increase in the level of safety within the terminal area should more than compensate for any delays experienced.

Since Stage III Radar Service is provided in all Terminal Radar Service Areas (TRSA) and Terminal Control Areas (TCA), the following tips should help pilots when operating within these areas.

a. Check the aerodrome listing in the FLIP Enroute Supplement to find out if your destination lies within a TCA or TRSA. If it does, it will be annotated in the communications listing, i.e., Las Vegas Terminal Control Area, Stage III Radar SVC, etc.

b. Become familiar with the structure of the TRSA or TCA during preflight planning. Depictions of TCAs are contained in FLIP AP/1 and the Airman's Information Manual (AIM), Part 4. TRSA graphics are portrayed in AIM, Part 4, which can be found in the flight planning section at your local Base Operations.

c. Upon initial contact with the controlling ATC facility, state your intentions, i.e., type of approach (visual overhead pattern, ILS, visual straight-in, etc.) and type of landing (full stop, touch and go, low approach, etc.).

d. Promptly acknowledge and comply with control instructions. Since most locations using Stage III have a large amount of traffic, keep radio transmissions short and concise.

e. When meteorological conditions permit, regardless of type of flight plan, the pilot is still responsible to see and avoid other traffic, terrain, or obstacles. Do not depend solely on radar traffic advisories, since within a TRSA, some aircraft

CONTINUED

may not be participating in the Stage III service. All aircraft are required to receive an authorization to operate within the TCA from the controlling agency and all aircraft will be radar separated; however, pilots still should apply the see-and-avoid principle.

f. If you are on an IFR flight plan, do not cancel IFR in hope of avoiding delays. Since all participating aircraft, whether IFR or VFR, are sequenced for landing, a pilot will gain no benefit from cancelling IFR.

g. In most TCAs and TRSAs, visual approaches are used to expedite traffic movement. If you don't desire a visual approach, advise ATC. After being cleared for a visual approach, proceed to the airport and remain in VMC. Acceptance of a visual approach clearance is acknowledgement by a pilot that he will ensure a safe landing interval behind the preceding aircraft and he accepts responsibility for his own wake turbulence separation.

h. Most important of all, if you have a question concerning a clearance or an ATC instruction, don't hesitate to request clarification. Arrivals to and departures from aerodromes utilizing Stage III Radar Service should not pose any additional problems to the well-informed pilot. By having a thorough knowledge of the services provided and the limitations of Stage III Radar Service, pilots should, in fact, be provided a greater degree of safety when operating within a Stage III environment.

Do you have a gripe, complaint, or question that is really bothering you? Whether your problem involves published approaches, procedures, or air traffic control, the USAF Instrument Flight Center is ready to help you. Just pick up the nearest phone and call AUTOVON 487-4276/4884, or Area Code 512-652-4276/4884. ★

HOW TO STAGE A SINGLE engine landing

mail call

Send your comments and questions to:
Editor, Aerospace Safety Magazine
AFISC/SEDA
Norton AFB, CA 92409

Your fine magazine is part of our regular fare here at the maintenance division of Central Air Force Reserve Region Headquarters. (CenAFRR/LGMV)

Pride is an inherent part of our being as much as the aircraft we fly, missions we accomplish, and defense posture we help to maintain.

Until recently our flying safety record was either not recognized or was lumped together with gaining command statistics. Not listed separately as was ANG.

Reading your July 1976 issue of "Safety Awards for 1975" we again find most commands represented except AFRES. In this case we apply under your "Explosives" category, as we possess two fighter wings and one AC-130 SOGp, operating from seven locations, flying daily range missions. As an armament technician I have intimate knowledge of each of these units and their explosive safety records which are second to none!

My question is, why are we not represented in your statistics for awards? Do you possess data from AFRES? How is data submitted or gathered by your staff? Were any of our units in competition for your

It was a beautiful afternoon as Lieutenant Jon Smith walked out to his T-38. He liked solo flying. It allowed him to experiment a little and really get the feel for the aircraft. Besides, it was nice not having an instructor critiquing each little error. As he crossed the warm, sunny ramp toward the aircraft, the fledgling pilot reviewed his flight profile for the mission. "I really need to work on my Immelmann and barrel roll. I need a good grade on my contact check. Okay, so I'll start with a barrel roll entry and then do an Immelmann; after that, I do a couple of other maneuvers and then come back for some patterns. Let's see, 838 is mine. It looks ready to go."

After an uneventful preflight and start, aircraft 838 is cleared for takeoff and proceeds to the practice area. Soon, high above the western plains Lieutenant Smith hears: "Rory 641 cleared golf area, block altitudes 12,000-26,000." Lieutenant Smith then starts his letdown, and as the airspeed builds, sets up for a barrel roll.

The barrel roll goes well and, quite pleased with himself, Lieutenant Smith then rolls over into a descent to gain airspeed for an Immelmann. "Let's see, 500 knots. Okay, start the pull up. Hey, what's the matter with the EGT on the left engine? It's zero! But everything else indicates all right. I better check this out."

In order to check out the problem, Lieutenant Smith breaks off the aerobatic maneuver and begins to climb slowly. As he climbs he leans forward and taps the number one EGT gauge. It stays at zero. The next step, Lieutenant Smith decides, is to retard the throttle to idle. Shortly thereafter the master caution light and the left generator light come on. When Lieutenant Smith looks at the rpm it is at 40 percent. Although he is somewhere around FL 220 with one throttle in idle, the pilot does not think to check his airspeed, which is decreasing through 195. Instead, he merely advances the throttle and when the engine rpm does not recover, shuts down the engine and heads for home.

Next morning, Lieutenant Smith is rather proud of his cool handling of the emergency. Unfortunately, his IP is not totally impressed. It seems that the only problem with the engine was an EGT gauge malfunction. The reason the rpm decayed and would not recover is explained in Chapter Seven of the Dash One. Below 200 KIAS and above FL 200, with the engine in IDLE, the rpm will decay below normal idle rpm and cannot be recovered by advancing the throttle. The proper remedy is to lower the nose and increase airspeed above 200 KIAS. After a short, rather pointed discussion with the IP about the subject, Lieutenant Smith concludes that perhaps a more thorough knowledge of the Dash One would be to his advantage.

This is a fictitious account based on several incidents which have occurred recently. Lest you discount them as the foibles of students, several similar mishaps involved highly experienced pilots.—Ed. ★

award? Finally, what can we in AFRES do to receive the recognition we have justly earned as part of the aerospace team?

Respectfully
WILLIAM W. SHERMAN
Equipment Specialist (Ordnance)
Bergstrom AFB TX

The Directorate of Aerospace Safety is not purposely discriminating against Air Force Reserve in awarding safety plaques. The problem is that we cannot make an award unless we know the unit is eligible. And the only way for us to know that is for the unit to be nominated.

Most of the questions you asked in your letter are covered in AFR 900-26 "Safety Awards." Since you mentioned the explosives category, here is a brief summary of the nomination and selection procedures:

First, any operational wing, group, squadron or comparable organization engaged in explosives operation is eligible for the award in Category I. AFR 900-26 gives a list of selection criteria. These are not the only ones which can be used but the guiding principle is some positive achievement or contribution to explosives accident prevention.

Normally, a MAJCOM nominates one unit in each category. The procedures for Air Force Reserve are slightly different. Each reserve region commander forwards nominations to the commander, HQ, AFRES. The commander then selects one nominee in each category and sends the nomination to the Air Force Inspection and Safety Center.

The USAF Safety Awards Board makes selections for the award from among those organizations nominated by the MAJCOMS. The nominations are evaluated by 15 April each year.

Finally, the best thing you can do to make sure you receive recognition for your achievements is get with your unit safety officer, read AFR 900-26 and then send a nomination to your region commander. This same procedure works for the other plaques in flight, ground, missile and nuclear safety. If you think you might be eligible check AFR 900-26—Ed.

Mail Call

CONTINUED

Sir, we at the 53d Tactical Fighter Squadron noted with great respect the accomplishments of the 336th Tactical Fighter Squadron at Seymour Johnson in attaining 8 years and 58,500 hours since their last accident. However, we must point out that the last accident in this unit was nearly 10 years ago in October of 1966 and that since then the 53d "Tigers" have flown over 66,500 hours. Our congratulations to the 336th on their noteworthy accomplishment.

FREDERIC S. FITZSIMMONS,
Lt Col, USAF
Commander
53d Tactical Fighter Squadron

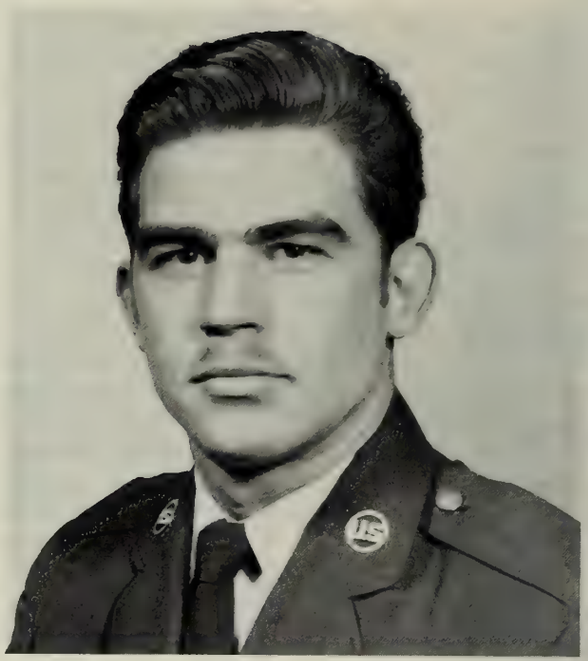
I read the article on the 336th TFS flying record. I wish to add my congratulations and those of the 179th Tactical Airlift Group. It is no small feat to fly eight years accident free in fighters.

But while their record is outstanding, it is hardly "unprecedented." From May 1967 to Feb 1976 we, the 179th Tac Ftr Gp, Ohio ANG. flew T-33s, F-84s, and F-100s for over 8½ years accident free (see letter to Ed. *Aerospace Safety*, Dec 75, Capt James F. Robertson). Also, I believe the 103d Tac Ftr Gp, Connecticut ANG has an even longer period of accident free flying in F-102s and F-100s.

JAMES A. KEHRLE
Lt Col, OHANG ★

GLOSSARY AVAILABLE

The FAA has published a new and expanded Air Traffic Control Glossary designed to enable pilots and controllers to speak the same language. Until December, pilots can obtain their own free copy from any FAA facility by presenting a current airman's medical certificate.



Sergeant

ROBERT C. CREVIER

Detachment 18, 39th Aerospace Rescue and Recovery Wing
Plattsburg Air Force Base, New York

On 31 December 1975, Sergeant Crevier was refueling a UH-1N helicopter at Loring Air Force Base, Maine. After properly bonding the aircraft and completing the applicable refueling checklist items, Sergeant Crevier began filling the main fuel tank with JP-4 fuel. Approximately 65 gallons of fuel had been pumped into the tank when, without any warning signs, a flash fire erupted. Reacting instantly, Sergeant Crevier immediately discontinued the refueling and began fighting the fire. He first tried to use a 50LB CB fire extinguisher which was positioned next to the aircraft, but the nozzle was firmly frozen and would not operate. Next, he called to the driver of the fuel truck to bring his fire extinguisher, but it also malfunctioned. Finally, Sergeant Crevier rushed to the aircraft cockpit and secured a small, type A-20 fire extinguisher located next to the pilot's seat. He returned to the fire and successfully extinguished it. As a direct result of Sergeant Crevier's actions, the fire was extinguished in less than a minute and the aircraft received negligible damage. Sergeant Crevier's quick reactions, sound judgment and personal courage during this emergency saved a valuable aircraft. WELL DONE! ★

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TED STATES AIR FORCE

Well Done Award

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Major
SAMUEL M. BROWN



Captain
DENNIS JORGENSEN



Technical Sergeant
LOUIS E. BOOS



Staff Sergeant
TERRY L. BEAVER

Dobbins Air Force Base, Georgia
700th Tactical Airlift Squadron

On 16 October 1975, Captain Jorgensen and his crew were flying a tactical training mission in a C-7A aircraft. The mission was scheduled to include a tactical training bundle drop followed by a short field landing. After completing the air drop, the aircraft entered the traffic pattern for landing, and the landing gear lever was placed down. The right main gear indicated unsafe. Major Brown, Sergeant Boos, and Sergeant Beaver confirmed that the right main gear was stuck in the wheel well. The next two hours were spent trying all flight manual procedures and suggestions from technical representatives of deHavilland Aircraft of Canada, San Antonio Air Logistics Center, Warner Robins Air Logistics Center and Dobbins Air Force Base. When all attempts were unsuccessful, Major Brown, Sergeant Boos, and Sergeant Beaver decided to remove the cabin windows adjacent to the right wheel well and use an aircraft seat rigging rod, attaching hooks used to hang parachutes inside the aircraft to the end of the rod. The following hour was spent pulling on the wheel well gear door and replacing hooks that had become straightened due to the forces being applied. Finally, the right main gear door opened and the gear dropped to the locked position. The extraordinary skill and ingenuity of Major Brown, Captain Jorgensen, Sergeant Boos, and Sergeant Beaver possibly averted a serious aircraft accident and loss of life. WELL DONE! ★

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NOVEMBER 1976

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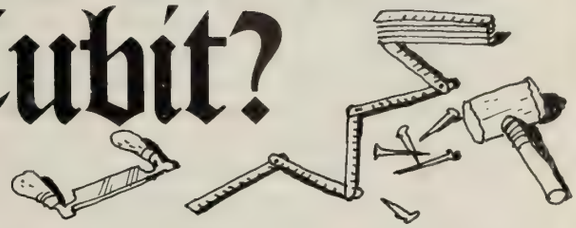
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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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NOVEMBER 1976 AFPR 127-2 VOLUME 32 NUMBER 11

What's A Cubit?



MAJOR R. B. BATEMAN
Air Force Flight Dynamics Laboratory
Wright-Patterson AFB OH

Those who are familiar with Bill Cosby's version of the story of Noah and the ark, will recall Noah's predicament after receiving a complete and rather detailed set of dimensions for building an ark. In order to interpret the instructions, he had to ask, "What's a cubit?" There was also some doubt as to just what an ark was, since not many had been built prior to the flood.

Noah's problem was nothing more than an early example of a lack of communication. Had he received a set of instructions on how to get the ark out of a whirlpool, his confusion factor might have gone even higher. Judging from the recent flood of stall and spin accidents, that same lack of communication is still with us. The authors of the various Dash Ones are quite explicit about what happens to aircraft when critical angles of attack are exceeded, but somehow, the dry language of a tech order does not impart to the pilots the dynamics of what can be a rather exciting trip, to say the least.

While pilots of the Fifties were busy breaking the sound barrier, and pilots of the Sixties were attacking the heat barrier, the pilots of the Seventies are faced with the problem of a language barrier. Consider the term "post stall gyration." From an engineer's point of view, this term refers to things that happen to an airplane while it's stalled, subsequent to the initial stall. This term was quite adequate for pilots 20 years ago, when wings were generally straight and the stall could be recognized by the sharp departure from controlled flight. At the onset of the stall, lift was lost and the nose fell rapidly through the horizon. Things that happened to the plane after this stall occurred, (like wild gyrations) were easily identified by pilot and engineer as post-stall events.



For today's pilot, things are not the way they were. For the highly swept, low aspect ratio wings that are characteristic of today's fighters, the stall is not a definite occurrence. It is a condition which may be entered by degrees, often without an initial loss of lift or altitude. It has been defined as "either the peaking of aerodynamic lift, or the occurrence of uncommanded aircraft motion about any axis, or the onset of intolerable buffet." What the engineer means is: Stalling a high performance aircraft can bring on some surprises. A pilot can get well into a stall—past the initial indications—without knowing it. If he does not know that a stall has occurred, the rapid (and readily recognizable) departure from controlled flight, that the engineer calls a post stall gyration, appears to be the stall itself. From a pilot's point of view, a more accurate term might

What's A Cubit?

continued

be simply "stall gyration." It refers to gyrations that occur *before recovery* from the stall.

Now, for those who are just now unscrewing their heads from the ceiling after reading that pilots may not recognize stalls: a few words of explanation. Recall first, that the departure, the stall gyration, can occur at any point after the stall. Now, review the definition of a stall. Notice that "wing rock" is nothing more than a specific case of "the occurrence of uncommanded aircraft motion" about the longitudinal axis. Does a pilot identify wing rock as a stall? No, dummy, he identifies it as wing rock. He has seen it many times. It happens when he pulls back on the stick. It seems to stop when he releases that back pressure. Wing rock, man, is E-Z! You don't even lose altitude. If you need to pull a little more, you have to put up with a little more wing rock, but you get your increase in lift, just like you wanted. Even the engineer will agree with that. He has curves to show that lift increases with angle of attack, despite the loss of longitudinal stability.

Here's the catch! Once the pilot has failed to identify wing rock as a stall, there is no warning between him and a sudden loss of control. And to make matters worse, one difference between wing rock and loss of control is the several thousand feet of altitude needed for recovery from loss of control.

Suppose a pilot is flying a circling approach at a strange field. Suppose he overshoots the turn to final, and pulls a little harder to bring it around. Suppose he gets some wing rock. Suppose he's seen wing rock before. Suppose he is surprised when the aircraft goes out of control. Do you suppose there is enough altitude for recovery? Do you suppose the surprise lasts long? (Editor's Note: Do you suppose the author made this up? Actually, two recent accidents exhibited this same pattern.)

If wing rock seems to be a primrose path, consider buffet. Buffet is not a stall—anymore. Intolerable buffet is. Beware of intolerable buffet! Be especially wary of anyone who tries to define it. Nonetheless, should intolerable buffet be reached, departure from controlled flight should be expected.

Teaching a pilot to recognize and identify a stall is like teaching a swimmer to recognize deep water; despite the dangers, he is still likely to play around the area.

There is really nothing wrong with this, for the swimmer or the pilot. It is important for a pilot to know his own limits as well as the limits of his aircraft. As a matter of fact, a contributing factor in at least one recent stall spin accident was a two year lapse in demonstrating proficiency in stall recognition and recovery.

The trouble with current stall recognition training is that pilots are required to recover at the first indication. This is not unlike having a swimmer practice cramp recovery in two feet of water. It may be even worse. In practicing these stall recoveries, a pilot inadvertently (and incorrectly) learns that he can recover without losing much altitude. He learns that he can do this whenever he wants to. He also learns that various check pilots require varying amounts of buffet and wing rock before initiating recovery. Recovery from an approach to a stall is a piece of cake. Most pilots could do it without practice, yet it is practiced, because it is required.

Recovery from a fully developed stall is not so easy. Recovery from an out-of-control condition can approach the impossible. Pilots do not practice these maneuvers. They are dangerous. Not all pilots know how dangerous, and some pilots find out the hard way. Some find out too late. Stall indications in most fighter aircraft do not provide warning of an impending departure from controlled flight. For this reason, any pilot can inadvertently put his plane in an out-of-control condition. There is a need to learn, through practice, the correct recovery procedure and the magnitude of altitude lost during this gyration.

It is not necessary to be stupid to stall an airplane. It may be stupid not to know how much altitude is required for a safe recovery. It is definitely stupid not to know how to recover. Like a MIG at 6 o'clock, an out-of-control maneuver tends to make one's IQ approach zero. Since (hopefully) no one reading this article is out-of-control right now, plant this seed in a fertile corner of your brain. Recovering an aircraft from a stall is not a memory exercise, nor a complex computational task. It is a precise motor skill. Like athletes, pilots must practice motor skills in order to develop proficiency.

Having gained one kernel of knowledge, let's return to an investigation of the language barrier. It is understandable to read in some tech order that "snap rolls" are prohibited. The authors might as well prohibit Danish Rolls, or diddle maneuvers. The average pilot does not

This article will not solve the stall/spin problem. It will not tell anyone how to avoid a

know what a snap roll is. He has never done a snap roll because (1) it has always been prohibited, and (2) training restrictions have prevented him from learning the proper entry conditions and control movements. Since snap rolls are just not done, it is easy to see why snap roll recoveries are not taught or practiced. For all of the above reasons, it is often the case that the first snap roll a pilot ever sees occurs suddenly as the result of applying the wrong controls at the wrong time. The immediate result is that he is turned every way but loose in a violent, disorienting maneuver. At this time he either invents snap roll recovery procedures and applies them, or becomes another unpleasant statistic. In either case, it is unlikely that the pilot was concerned with the name of his particular stall gyration. (That's right, a snap roll is a stall gyration.) One alternative is to explain how to do a snap roll, with the attendant risk that somewhere there is a pilot who will go out and try one. Another possibility is to prohibit the general type of maneuver, without providing the unique name.

Returning to the language barrier, every pilot knows how to stall and spin an airplane. When a pilot reads that these maneuvers are prohibited in his airplane, he at least knows what the engineer is writing about. The professional pilot, prohibited from doing these maneuvers, will turn to his tech order to read about what *might* happen, should he ever encounter these conditions inadvertently. In most cases, he will run straight into the language barrier. Consider section six of what should be identified as the best tech order available when it comes to maximum performance maneuvers. The particular aircraft has some rather onery characteristics during departure from controlled flight. The aeronautical engineer is describing accelerated stalls:

> The approach to stall is characterized by heavy buffet and very frequently a high yaw rate at the stall.

The language is precise. The sentence is carefully worded. What the engineer means, Captain, is that yaw rate increases to over 125 degrees per second, as the nose yaws half way around the world, slams the canopy against your helmet with a 4.5 g *lateral* acceleration to get

ll or what to do if a stall occurs. It is an assault on the language barrier.



The approach to stall is characterized by heavy buffet and very frequently a high yaw rate at the stall.

your attention and then wraps up the "departure from controlled flight" with pitch and roll oscillations that would make a sailor sick. Further, if you try to hang on to the stick (and the good Lord knows you need to hang on to something) you may make matters *worse*. ("Worse" is not defined. The reader is encouraged to use his own imagination.)

The information contained in the preceding paragraph may be gleaned from eight pages of description in the dash one. Not many jocks are inclined to memorize that much material. Those who do are likely to forget it about halfway through the first turn. Pilots who have experienced a full stall and departure in this aircraft are unlikely to ever forget the gyrations. Here is another kernel of information: In order to gain an appreciation of the consequences of stalling an airplane, it is necessary to actually stall the airplane. Approach to a stall is not enough. Reading about it is not enough.

What's A Cubit? continued

Unfortunately, actually stalling an airplane is often too much. Accident reports on nearly 20 stall/spin accidents from 1974 to date provide ample evidence that stalls can be hazardous to your health. Breaking regulations by performing prohibited maneuvers can be hazardous to your career, and is not recommended.

So what is a poor pilot to do?

In March, 1971, NASA published a Technical Note (D-6117) titled "Utilization of a Fixed-Base Simulator to Study the Stall and Spin Characteristics of Fighter Airplanes." Available from NTIS, Springfield, VA 22151, for $3.00, it has not made the best seller lists among fighter pilots. As a result of this study, the authors concluded that ". . . fixed base simulators can be used for study of stall and spin characteristics of high performance airplanes . . ." providing the aerodynamic model includes the high alpha stall and spin region. Unfortunately, it is not easy to gather the data for the aerodynamic model, and so the model may not produce characteristics that are faithful or consistent.

Two aircraft configurations were used. The aerodynamic characteristics closely resemble the F-111 and the F-4, although the specific models were not identified. Quoting from the report:

> In the area of pilot training, the simulator could provide a means of training pilots for spin prevention and recovery. In this manner, pilots could (1) become familiar with the unusual flight motions . . . (2) learn . . . instrument and visual cues . . . (3) become familiar with proper control inputs. . . .

It should be emphasized that the simulator motions may vary, and that the correlation with exact aircraft gyration may not be good. Such a simulator would, however, provide procedures training, and some experience in stall characteristics.

In April, 1973, Air Force Flight Dynamics Laboratory published a study (TR 73-29) in which a fixed base simulator with an outside view display and a full instrument panel was used to study stalls and departures of a single seat fighter. In June, 1974, Air Force Flight Dynamics Laboratory published TR 74-61, a study which used a fixed base simulator and CRT visual display to portray flight characteristics at high angles of attack. It may not be possible to simulate every aircraft in the stall regime, but it is possible to produce reasonable approximations for some of them.

If it is possible to provide stall and spin trainers, complete with outside visual cues, it seems apparent that pilots can benefit from such training. The engineer in the laboratory knows that a simulator can sometimes be used to duplicate the stall and spin characteristics of an aircraft. He is apparently waiting for some pilot to ask for such a simulator. Of course, the pilots haven't asked for it yet. They don't know what to ask for! The language barrier strikes again.

Nearly 20 airplanes have been lost since 1974 because of a cubit. What's a cubit? The length of a man's forearm. Improper use of cubits by pilots, and lack of knowledge about what to do with cubits after departure from controlled flight keeps costing us airplanes.

This article will not solve the stall/spin problem. It will not tell anyone how to avoid a stall, or what to do if a stall occurs. It is an assault on the language barrier. Lest the message get lost in the literature, I say again:

1. The familiar onset of a stall is not useful as a warning of an out-of-control condition; therefore, it can be predicted that when pilots maneuver in a maximum performance regime, out-of-control conditions will sometimes be encountered.

2. Reading about stalls, spins and recoveries is not an adequate substitute for experiencing them.

3. Since prohibited maneuvers cannot be practiced safely in flight, simulation of these maneuvers is an alternative whose benefits have been demonstrated for some aircraft.

Obviously, the operational commands do not have the elegant simulators needed for accurate stall/spin simulation. Has anyone ordered them or established an operational requirement? In the meantime, has anyone tried using the existing simulators for stall/spin training? Even if the simulation is not 100 percent accurate, the recovery procedures can be practiced. It's time we learned what to do with our cubits. ★

MODERN WEAPONS EMPLOYMENT

CAPTAIN ARTHUR FOWLER
Directorate of
Aerospace Safety

WAR! A situation we try not to become involved in but one we must always consider. It is imperative we conduct it as safely as we do our day-to-day training. In the early history of war, the caveman found safety to be a relatively simple task. His weapons, the rock and club, were simple and easy to employ and there were few problems with explosive accidents, target miss ID, or collateral damage. The cave safety officer simply piled his rocks in a corner and cautioned the warriors against ground accidents—like dropping a club on someone's foot.

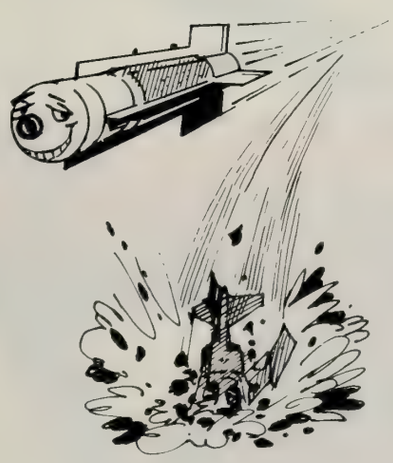
The combination of the airplane and high explosives (bombs) in modern war caused the institution of a new safety concept. Ground safety, even though it is continually being improved, has been able to maintain the same basic concept of operation. Flying safety, especially in the area of weapons employment, is being forced to change its philosophy because of the sophistication of our modern weapons.

The original era was that of "The dumb bomb and the smart bomber." Let's use the arena of close air support to emphasize the need for the change in thinking. Anytime ordnance is being dropped in the area of friendly forces/people, we become very concerned about bombing accuracy and collateral damage (especially if the collateral damage is the 9th Infantry and your mother wears combat boots). As a result, we have established criteria for how close to friendlies we can drop ordnance. This is based on the frag envelope of the weapon plus the bombing accuracy of the aircrew. In the era of the dumb bomb (unguided), it was very easy to establish a small area where it was highly probable that the bomb would hit. Unfortunately (for the safety officer), we have advanced into the age of terminal guidance.



Let's call our new era that of "The smart bomb and the not-so-smart bomber." Those who thought I would say dumb bomber take two steps backwards. Terminal guidance uses laser energy, TV, or infrared as a means of guiding the bomb to the target. These weapons have proved to be much more accurate than the conventional dumb bomb. For example, the Maverick missile's design criteria was to be able to hit no further than a few feet from the target's center. It would seem a logical conclusion that we should therefore use these weapons in a close air support situation where accuracy is paramount.

The problem arises in the establishment of a weapon miss distance. The guided weapons incorporate big fins (some have wings) and even rocket motors to increase the accuracy and range of the weapon.



The weapon miss distance is graphically portrayed on what is called the weapon footprint (that area in which the weapon could hit after launch from the aircraft). This area can extend as far as 10-15 miles from launch and with some new weapons being developed, this distance will triple. Some terminal guided weapons can guarantee over a 90 percent probability of a direct hit on the target. If you require only to be within 200 meters, they can guarantee well over 95 percent.

The problem is the 1 or 2 percent remaining can fall anywhere within the footprint (an area as large as 60 sq. miles). To the staunch safety officer this might be too high a risk to be considered safe; but to the trooper on the ground who needs the accurate ordnance in order to stay alive, it is considered plenty safe enough. So, what is safe?

We are faced with a dilemma!! On the one hand we have a weapon that is surgically accurate and desirable; but, on the other hand it can malfunction and travel many miles from the target with a remote (less than .0025) probability of falling into the midst of friendly forces. The answer is in education, knowing what the weapons can and can't do and what risk is involved. As we move into the age of sophistication, airplanes will need to stand off from the battle line in order to survive and the Army will still need highly accurate bombing support. The answer is Terminal Guided Weapons! If we allow our archaic thinking in weapon employment to continue, we could eliminate the use of highly effective weapons in the protection of our ground forces. Let's open our minds and take a long look at our present policies. Times are changing and we mustn't fall behind. ★

General Aviation Fuel Which Is Right?

MAJOR PHILIP M. McATEE
Directorate of Aerospace Safety

During the past few years, several significant changes have occurred in the availability and lead content of general aviation aircraft fuels (figure 1). These changes have left many doubts and much controversy over what fuel should be used. Since many *Aerospace Safety* readers are operators of aircraft in this category, we felt it would be beneficial to pass on the recommendations of the major engine manufacturers on the subject of aviation fuel.

The controversy started when several oil companies ceased to manufacture 80/87 octane aviation fuel and in its place introduced a new 100 octane low lead (100LL) avgas. Many thousands of light aircraft currently flying were designed to use 80/87 fuel. However, several areas of the United States and some overseas areas no longer sell 80 octane fuel at all, leaving many pilots concerned about which fuel should now be used and what will be the consequences.

Before we begin, let me state emphatically that in *no instance* should any automotive fuel be used regardless of its advertised octane or features, because of the corrosive effect of its chlorine content and danger of vapor lock caused by its much higher vapor pressure.

Many engines are still designed for 80 octane fuel; and this fuel should be used when it is available. When it is not available, both Lycoming and Continental approve of the continuous use of 100LL in which the lead content is limited to 2 ml. TEL (tetra ethyl lead) in *all* of their engines with some recommendations to reduce problems.

The following recommendations are taken from Lycoming Service Letter No. L185 and are illustrative of those of all manufacturers:

FUEL MANAGEMENT

- Never lean the mixture from full rich during takeoff, climb or high performance cruise operation unless the airplane owner's manual advises otherwise. During takeoff from high elevation airports or during climb at higher altitudes, roughness or reduction of power may occur at full rich mixture. In such a case the mixture may be adjusted only enough to obtain smooth engine operation.
- Operate the engine at maximum power mixture for performance cruise powers and at best economy mixture for economy cruise power, unless otherwise specified in the airplane owner's manual.
- Without exception, observe the red line cylinder head temperature limit during takeoff, climb and high performance cruise power operation.
- For maximum service life, maintain the cylinder head temperature below 435°F during high performance cruise operation and below 400°F for economy cruise powers.
- Always return the mixture to full rich before increasing power settings.



• During letdown and reduced power flight operations, it may be necessary to manually lean or leave mixture setting at cruise position prior to landing. During the landing sequence, the mixture control should then be placed in the full rich position, unless landing at high elevation fields where leaning may be necessary.

During cruise, follow the airplane owner's manual for the best method of manually setting maximum power or best economy cruise. Recommended fuel management, manual leaning, will not only result in fewer engine deposits and reduced maintenance cost, but will provide more economical operation and a fuel savings.

LUBRICATION

Many of the engine deposits formed by use of the higher leaded fuel are in suspension within the engine oil and are not removed by a full flow filter. When sufficient amounts of these contaminants in the oil reach high temperature areas of the engine they can be baked out, possibly resulting in malfunctions such as sticking exhaust valves.

For this reason, when you are using the higher leaded fuels, the recommended oil drain period of 50-hours should not be extended. If you encounter some valve sticking the oil change interval should be reduced.

SPARK PLUGS

Spark plugs should be rotated from top to bottom on a 50-hour basis and serviced every 100 hours. If excessive spark plug lead fouling occurs, the selection of either a hotter or colder plug, depending on type of lead deposit, from the approved list may resolve the problem. Your A and P mechanic can advise you on plug selection. Depending on the lead content of the fuel and the type of operation, more frequent cleaning of the spark plugs may be required.

VALVES

For Continental engines some further recommendations are made by the manufacturer. As an interim measure, Continental had previously recommended that on certain engines the valve seat angle be changed to 30°. This has now been superseded as a result of extended engine testing.

Extensive testing both in the laboratory and the field has shown that with the use of higher leaded fuels, service life of the intake valves can be significantly improved by introducing the following changes:

• Installing a new type valve with a new 60° seat angle for improved sealing.

• Installing a new valve seat of improved material to minimize erosion. Continental states that it is highly desirable to install these new components at the next top or major overhaul, whichever comes first. These new parts have been available since May of this year.

The models affected by this recommendation are: C75, C85, C90, O-200, O-300 and GO-300. Engines that were previously modified to the 30° seat angle should have the new components with the 60° seat angle installed in accordance with Continental Service Bulletin M76-8 at the next top or major overhaul.

So now what have we said? Although the new 100LL fuel is approved for all Lycoming and Continental engines when 80 octane fuel is not available, the continuous use of this higher leaded fuel *will* result in increased engine deposits both in the combustion chamber and the engine oil. This will mean reduced oil change intervals, more frequent spark plug maintenance and recommended valve changes on some engines. The frequency of plug servicing and oil drain periods will be governed by your type of flying. The longer operation requiring full rich mixture, the more frequent maintenance required.

All the above recommendations are for using 100 low lead fuel. If you must use regular 100 octane or 100/130 fuel with 3.0 ml. TEL/US gal then additional inspections, particularly exhaust valve inspections, may be required on all manufacturers' engines. Check your engine manufacturer's service bulletins or ask your A and P mechanic.

It looks like the new fuels are here to stay. By using good judgment and following the manufacturer's recommendations, you will enjoy many hours of flying more economically and with fewer problems. ★

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572E) Amendment No. 3		
Grade	Color	Max. TEL ml/U.S. gal.	Grade	Color	Max. TEL ml/U.S. gal.	Grade	Color	Max. TEL ml/U.S. gal.
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	**3.0	100/130	green	**3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

* - Grade 100LL fuel in some over seas countries is currently colored green and designated as "100L".

** - Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

runway surface hazards

Applied research has improved both aircraft braking systems and pavement surfacing systems, but unfortunately, at times, these two systems can work against each other to put the aircrew in a hazardous position. For instance, an aircraft landing on a wet runway having a concrete touchdown zone and a primary braking area which has an improved traction surface presents such a case.

After landing, the pilot uses maximum aerodynamic braking, but prior to reaching the traction surfacing, he begins to apply the brakes. Because of rubber deposits and the relatively smooth concrete texture, aircraft wheel spinup may not have started; hence, the antiskid system (if available) would not sense ground speed. When the aircraft transitions into the improved traction area, the wheels are virtually locked up and the potential for blowing the locked wheel tires is great. Because of this abrupt change from a low to a high traction surface and the masking of the antiskid sensing subsystem, the pilot could face an emergency rather than a normal landing.

This problem of transitions can just as easily occur when the touchdown area is covered with rubber or the surface is worn and the aircraft passes to a better surface before the aircraft has sufficient time for wheel spinup. Either of these conditions may result in blown tires or a skidding incident which, in the main, are uncontrolled situations for the aircrews. Both of these situations occurred in recent USAF and civil aviation incidents. Luckily no loss of life was involved, but equipment and manpower resources were required to restore the aircraft to flyable condition.

These accidents occurred partly as a result of a lack of communications between engineers and operations personnel, and partly as a result of reliance on systems that are operating on the edge of their limits.

PAVEMENTS

Pavement engineers have over recent years developed, at the request of aircrews, surface treatments that provide a rapid recovery of runway skid resistance characteristics after a rainfall of any intensity. Two basic surface treatments prevail.

The first treatment is for concrete pavements. This generally puts some dimensional grooves into the surface either at the time of construction (plastic grooving or wire combing) or by cutting into the surface after a period of operation that has shown the surface is susceptible to hydroplaning or skidding. The second method of treatment are those applied to asphaltic type pavements. While grooving has been used successfully for asphalt at commercial airports, it is not generally used on USAF asphalt runways. The primary method of treatment on asphalt has been one of several types of skid/hydroplaning resistance surface courses. These may vary all the way from overlays which improve surface drainage (with no special surface preparation) to application of Porous Friction Surfaces which provide for water drainage paths through the pavement. See Figure 1 for comparison of recovery rates on different surfaces.



These treatments have been developed and, are being used. However, to reap their full benefits, the pavement engineers must inform aircrews where these treatments have been applied and define their advantages and limitations. Additionally, where new surfaces have been placed that may have different traction properties the aircrews must be knowledgeable of the potential hazards.

Economics play a vital role in the decisions about where, when, and how new surfaces are to be placed. As a result of aircraft tire damage and other economic considerations, antiskid/hydroplaning surface treatments are generally not applied to the first 1000-1500 feet of each runway end. In wet runway situations this sets up potential problems when transitioning between the touchdown zone and improved surface.

The second situation can develop as a result of inadequate attention to surface texture and/or drainage of pavements as well as lack of rub-

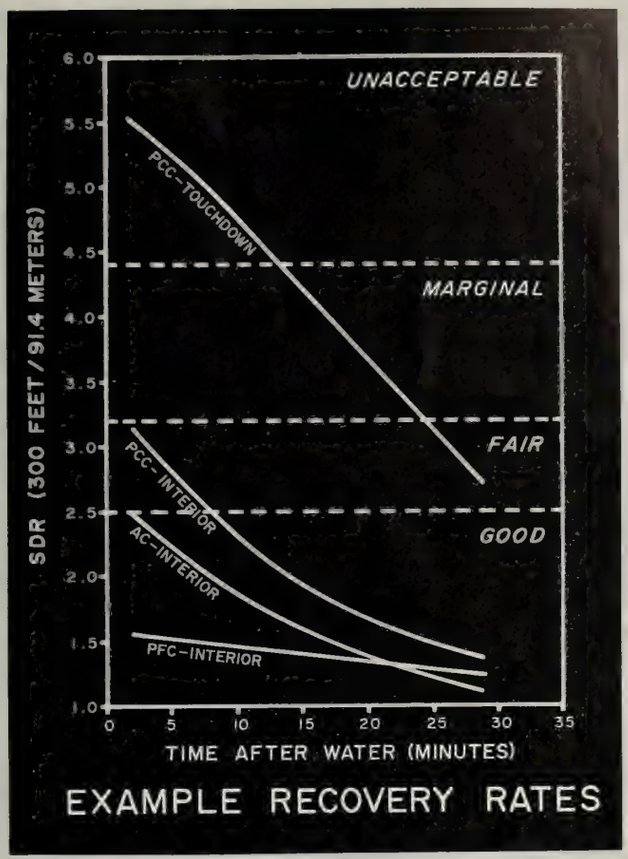
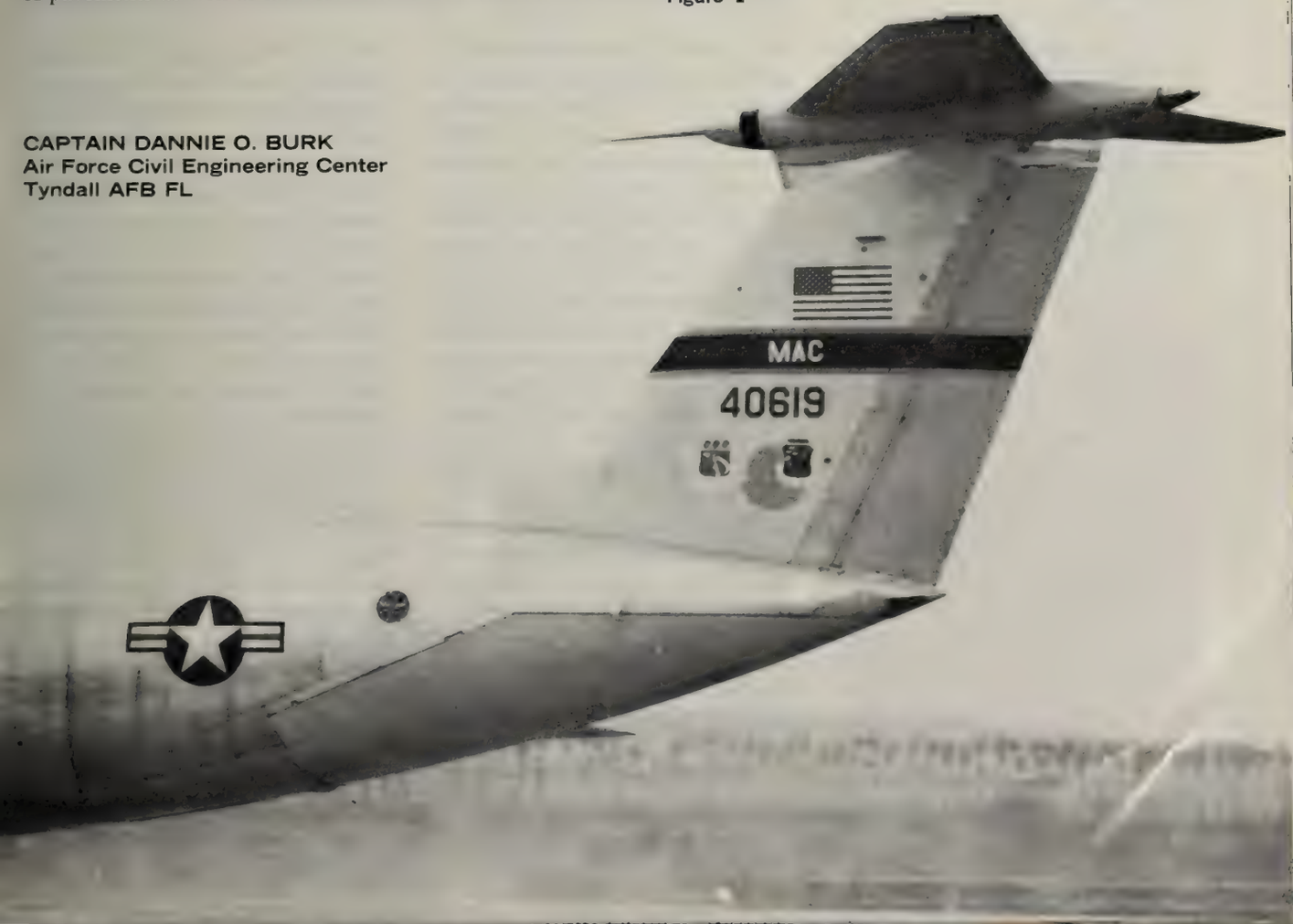


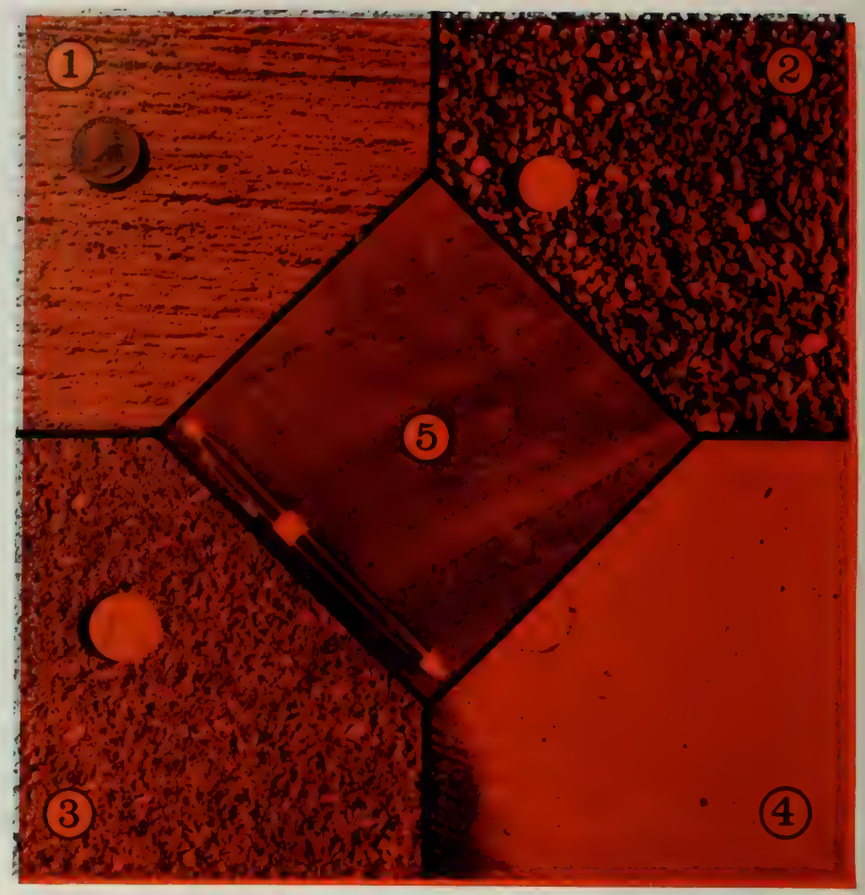
Figure 1

CAPTAIN DANNIE O. BURK
Air Force Civil Engineering Center
Tyndall AFB FL



runway surface hazards

continued



Different Runway Surfaces
1. Concrete (PCC) 2. Porous Friction Course (PFC) 3. Asphalt (AC) 4. Concrete (PCC) 5. Rubber Deposits Over Concrete

ber removal and/or too frequent rubber removal. Rubber deposits are defined as buildups that obliterate any pavement surface texture.

Both situations, one created by new technologies and one created by maintenance inadequacies, can lead to the same results and the aircrews should be aware of the potential problems, either through tower advisories, NOTAMS or IFR supplement descriptions.

PREDICTING AIRCRAFT RESPONSE

At this time the Air Force does not have a satisfactory method of predicting aircraft stopping distances (except in the case of ice and packed snow, where RCR is acceptable) and is not likely to develop a reliable, easily used system in the near future. But we have verbal descriptions (see table 1) for the skidding or hydroplaning potential for runways. These need to be provided to the aircrews. Although they provide limited information, these descriptions are available from Skid Resistance Reports, which have been prepared for most USAF bases.

SKID/HYDROPLANING EVALUATIONS

The standard skid test used by the Air Force Civil Engineering Center (AFCEC) was developed by the Air Force Weapons Lab (AFWL), culminating research conducted in the late 60's and early 70's. This research found that no ground vehicle could consistently predict the stopping distances of aircraft. As a result of this research, the inspection decelerometer method of arriving at RCR's was voided except in ice and snow conditions. The only method of evaluating the potential stopping distance of aircraft at this point is the wet runway RCR as recommended by the "Dash One" of each aircraft. This is a questionable value since each runway has a different set of surface friction characteristics. The present skid testing program attempts to identify runway sections with potential for skidding/hydroplaning. The report resulting from a skid test recommends improvements in the worst cases or advisories to aircrews when conditions do not warrant corrective action, but do present a potential problem.

The runways are evaluated with two basic types of measuring devices. In this article it will be sufficient to state that each piece of equipment evaluates the pavement's frictional characteristics in a slightly different manner and the results are jointly used to evaluate each runway. Table 1 provides a description of the results from both pieces of equipment. Skid testing divides the runway into four distinctive segments: primary touchdown, primary braking, edge, and secondary touchdown. Each segment of the runway is evaluated and results presented to reflect expected skidding/hydroplaning potential. The edge section is evaluated to obtain data on the wear characteristics of the runway. Table 2 gives some typical ranges of hydroplaning potential obtained for the different sections and the changes that can occur between different sections of the runway. Figure 1 points out the varying recovery characteristics that are anticipated for several sections and types of pavement surfaces. These recovery graphs are indicators of the time period that could be expended

NUMERICAL RESULTS AND THEIR MEANING

TABLE 1

Mu-Readings	SDR	Expected Response
0 - .25	4.4 and greater	Very high hydroplaning potential
.26 - .41	3.20 - 4.39	Potential for hydroplaning
.42 - .50	2.50 - 3.19	Transitional
.51 - 1.00	1.00 - 2.49	No hydroplaning anticipated

1. For a complete description of test procedures see any skid resistance report available at most bases.

2. Coefficient of friction (Mu) measured by an ML-Aviation Mu-meter.

3. Stopping distance ratio (SDR) as computed using a standard dry stopping distance (300 ft/91.4 meters) divided into wet stopping distance as measured by NASA developed diagonally braked vehicle (DBV). Limits based on ASTM E-524 tires incorporated into testing procedures in August 1975.

Ranges in the Skid potential of Runway Sections immediately after wetting.

TABLE 2

	MU		DBV	
	MIN	MAX	MIN	MAX
Touchdown Zones	.23	.82	1.8	5.5
Primary Braking Interior Sections	.37	.80	1.64	4.4
Edge Section (section with same materials as center line of runway but out of major traffic lanes)	.40	.84	1.18	4.3

in return to an essentially dry condition.

These differences between sections and surface type point out the problems that can develop. This emphasizes that some standard procedure should be used when landing on a wet runway.

METHODS OF AVOIDING THE PROBLEM

The best method of avoiding this potential problem is to not land on wet surfaces, but this is obviously impractical. Since the USAF must operate on wet runways, several simple precautions should be used to help avoid these possible situations.

1. Make maximum use of aerodynamic braking while the aircraft is in the touchdown zone and during wheel spinup.

2. Avoid brake applications while the aircraft is in the touchdown zone, rubber coated area, or in transition to primary braking area pavement.

3. Be aware when landing on up wind side of runway (runway assumed to have a crown) that water will tend to be standing deeper as a result of wind action against the natural drainage of the runway.

Other precautions to help avoid a skidding/hydroplaning situation.

1. If wet runway operation is anticipated, ensure some tread remains on tires.

2. As rainfall intensity increases, the potential for hydroplaning increases and the period of recovery is increased. Poor drainage increases hydroplaning potential on any runway.

3. When turning off the runway in a touchdown area, be aware of the reduced friction due to wear and/or rubber deposits. Reduce speeds accordingly.

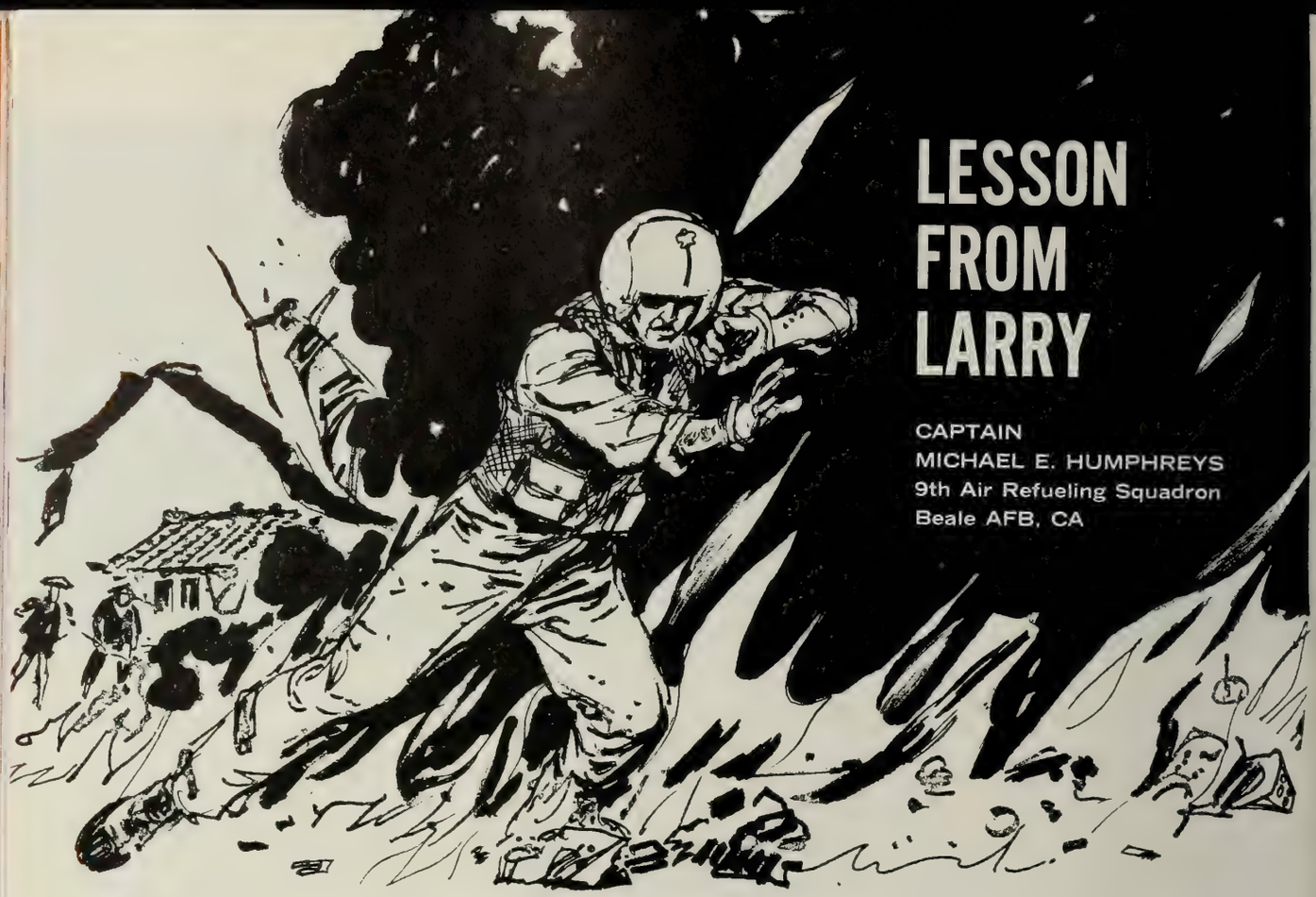
I have attempted to point out a problem that has developed and some of the things that can be done to avoid accidents which could be caused by the problem. The AFCEC is operating a continuous evaluation program to test runways for skidding/hydroplaning potential*. When problem areas are pinpointed, the AFCEC recommends procedures to alleviate or avoid the potential hazards pointed out by the test evaluations. ★

*One note to be injected at this point is that the testing is conducted as requested and justified by the base and not on a recurring basis. Changes in surface characteristics can occur as a result of wear or maintenance and this should be considered when reviewing older skid reports.



20 YEARS SAFE

Mississippi Air Guardsmen were flying B-26 aircraft like this one in 1956 when the unit sustained its only major aircraft accident. The accident, which happened 20 years ago, was attributed to material failure after the washer on the nose wheel malfunctioned. Since that time the Guardsmen from Jackson's 172nd Tactical Airlift Group have flown almost 85,000 hours in 5 different types of airplanes without a major accident. In the entire 23 years of the unit's history, no one has ever been killed or seriously injured as a result of an aircraft mishap.



LESSON FROM LARRY

CAPTAIN
MICHAEL E. HUMPHREYS
9th Air Refueling Squadron
Beale AFB, CA

The author's experience prompted a formal suggestion which, because of its relevancy to aircrews, is reproduced here. This does not constitute complete agreement with all facets of the suggestion, since some points are debatable. —Ed.

During 1972, while stationed at NKP, Thailand, flying CH-53's, I became acquainted with another pilot whom I'll call Larry (not his real name). Larry flew a hot little number called a QU-22. In case you have never heard of a QU-22, it was an off-the-shelf purchase of a lightplane with a turbocharged engine and *loaded* with relay avionics. It was well known for engine failure at inauspicious moments; also for coming apart around pilots inside thunderstorms. There was a good deal of competition among us helicopter guys whenever we saw a QU-22 on takeoff; we were always concerned over who was going to get the "pick-up."

It was a typical, hot, muggy, Thai afternoon the day that Larry taxied out for what turned out to be his last flight. QU-22 drivers were in the habit of leaving the door open until just the last minute before takeoff, in an attempt to get a breeze through the cockpit. This day Larry did too, closing it as he was cleared onto the active.

Sometime during the takeoff phase, the engine failed and Larry's QU-22 settled-in straight ahead and landed a couple of hundred yards off the end of the runway in the middle of a small Thai village. By the time the crash crew got to the site, Larry was already out of the burning airplane and standing a little distance away. He probably could have walked away from that wreckage without a problem except for one thing: because of the high humidity and temperature, Larry had taken off with his Nomex flight suit sleeves rolled up and his gloves turned down. Consequently, his arms, hands and back were badly burned. As the Flight Surgeon explained it to me later, it wasn't flame that burned him; it was heat so intense that it actually went up his open sleeve and burned his back. Had he been wearing his Nomex clothing properly, he would most likely be flying today. Larry was medevaced to Clark AB, where he died about 10 days later. Cause: he contracted pneumonia and his body just wasn't able to cope with both that and the severe burns. To say that his death was tragic, needless, and a complete waste would be a pitiful understatement. His death was caused by the fact that he chose to opt for a few minutes of comfort against the chance of being burned if an accident occurred. He gambled and lost. Immediately after Larry's death, the Wing there ordered a pen and ink change to all checklists. They were amended to read "Flight suit sleeves down and cuffed. Gloves on", before engine start. It was, in a phrase, a "day late and a dollar short."

The reason that I have put all this down on an AF Form 1000, is that I have seen the same trend among some other pilots I have

flown with. Having kept my eyes open while on the flight line, I have seen a lot of guys walking around with their sleeves rolled up during hot weather. I have also flown with enough different IP's in both T-37's and T-38's, in the helicopter-fixed wing conversion program, who flew the mission with their sleeves rolled up to guess that it is accepted practice to fly with bare arms. I think it is also safe to assume that at least *some* of the pilots walking around the flight line with rolled up sleeves have flown that way.

Another pilot once remarked to me, "What they should do is throw away all the manuals and regs and just say, 'Use good judgment'." The problem with that is the Air Force has learned the hard way that there are not enough people around who use "good judgment" consistently without some form of written guidance to help out. It is time for someone to set down written guidance about the hazard of flying with flight suit sleeves rolled up.

Captain Humphreys then suggested that directives be published, providing written guidance on the wearing of Nomex flight clothing.

I also strongly urge that the T-37 and T-38 checklists be changed to include a step in the checklist before engine start where the crew will ensure their sleeves are down *and cuffed* and gloves on . . . many habit patterns learned in initial training by UPT students will be carried over into later flying assignments. It is quite possible that someone's life could be saved at a later time in a different type aircraft because he developed, as a student, the habit of properly wearing his Nomex flight suit.

Editor's note: We would like to add another consideration to the proper wearing of the Nomex coverall, and that is mandatory wear of a cotton T-shirt under the flight suit. A layered effect increases the burn protection provided by Nomex. ★

The Professional Killer

CAPTAIN TOM FOLSE
25 TFS

Wait a minute! Don't throw this article aside until you read further. I know what you're saying: "Here comes another story about a stud fighter pilot who thinks he's the greatest thing since sliced bread." Well, you couldn't be further from the truth.

The person I'm speaking of is not an experienced combat aircrew member, not a "hundred-mission jet jock", but *you*, a highly-trained Air Force flight crewmember, and the killer in this case is what I call "professional nonchalance."

At some point in every crewman's career he reaches a plateau. He has been through that slow and tedious process of initial training in his chosen aircraft. He has taken the backseat, figuratively speaking, and has heard a thousand times, "You can't do it, because you haven't done it." Gradually, his responsibilities are increased in direct proportion to his flying time. At last he's a flight lead, aircraft commander, senior nav, or loadmaster. In general, he is good, and if you ask him, GREAT, if not the greatest, airman around. Understandably so, for he has worked diligently, learned rapidly, and waited patiently. For the moment, he can do things HIS way.

This trained flier no longer worries about starting the engines, aligning the INS, or preflighting his equipment. All of this comes naturally. After all, he has done it hundreds of times, and he could recognize any problem with his eyes closed. His abilities and capabilities are well known in his squadron. Further, he is recognized by his fellow airmen as a competent and knowledgeable flyer.

Then the inevitable happens! A call comes in from the command post for the operations officer: "Sir, one of your aircraft has just landed gear up." A bit drastic you say, but let's take a closer look.

How many times have you heard an "old head" say, "Just let me get one engine started, and I'll get this 'beauty' off the ground." Admittedly exaggerated, but you get the idea.

Have you ever told your backseater or copilot to disregard a portion of the checklist because you had already taken care of it? Even more basic than this, when was the last time you really checked those gauges and hacked the clock to see exactly when you got rotation, hydraulics, or oil pressure?

Better yet, have you ever said, "That's okay, chief, we won't need the primary heading system and attitude indicator—it's VFR today."

Without going further, the "big picture" becomes clearer. As we gain more and more experience, we tend to get away from all the sound basic training we have had and begin to ad lib or take chances we might not otherwise have taken. Sometimes whether we like to admit it or not, we even get a little careless and forgetful. That's just the time "the killer" will reach out and take a big swat at you. Think about it. . . . Is it worth risking all the blood, sweat and tears you have put into it, not to mention the extensive cost of your aircraft, just to save a few minutes? The answer is obviously, "No!" FLY SAFE! ★

THE IFC APPROACH

Ever have an instructor, teacher or professor tell you to ask any question, regardless of how basic it may seem, because someone else probably has the same question but is afraid to ask? We will use this philosophy and relay to you some actual questions that have been asked recently.

POTPOURRI

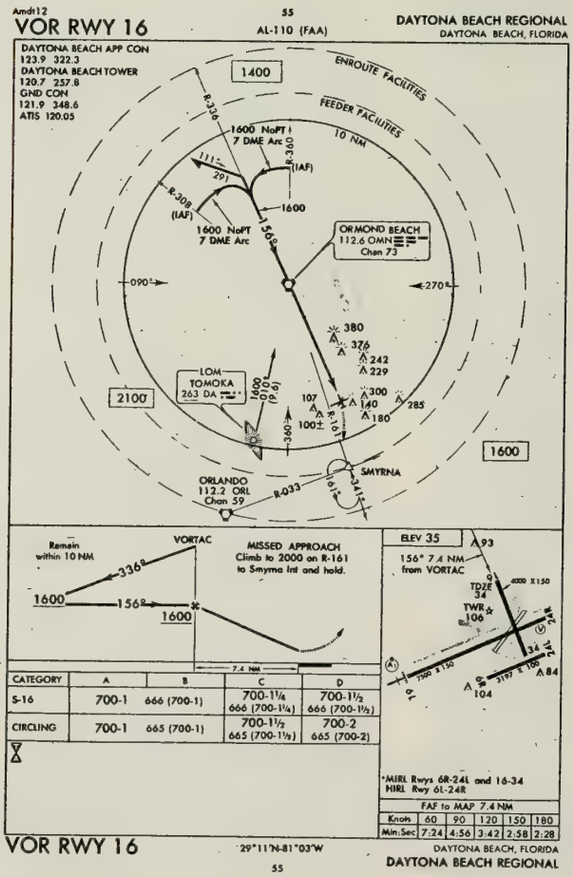
Q. FLIP General Planning states that I must file my IFR flight plan to an initial approach fix (IAF). My aircraft is VOR only so I can't file to either of the labeled IAF's in Figure 1. Since a procedure turn is depicted off of the Ormond Beach VOR, can I file to the omni?

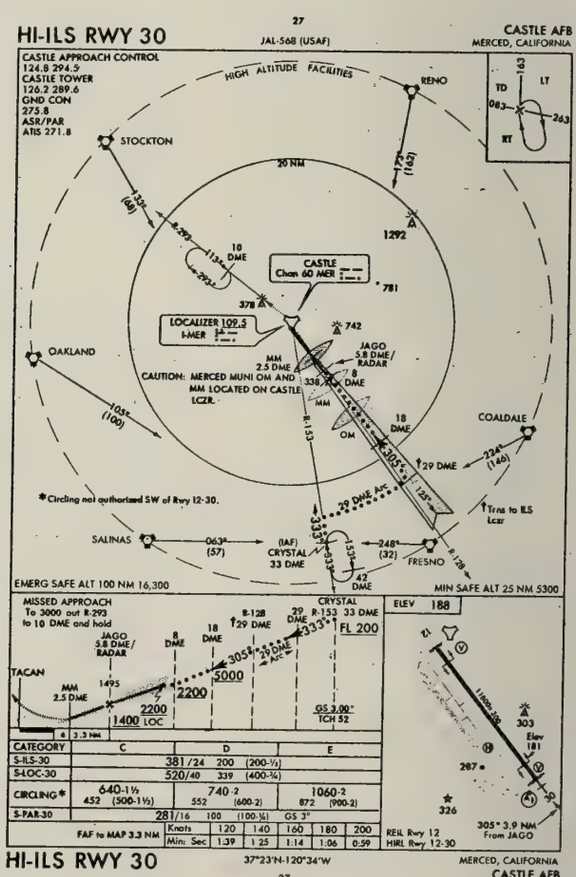
A. Yes. Even though the VOR is not labeled as an IAF, procedure turn fixes are IAF's (Ref FAAH 8260.19, para 1008.D).

Q. Reference the penetration tracks that are shown as dots on high altitude instrument approach procedures. Does each dot equal one nautical mile?

A. No. The only thing standard about those dots is their size and spacing. However, on the plan view of some approach plates, each dot does approximate a mile. In Figure 2, for example, the distance between the 153 degree radial and the 128 degree radial, on the 29 DME arc, is about 12 miles. How many dots are there? Amazing! Notice though, that counting dots in the profile view doesn't work. The dots between the 18 DME and 8 DME stepdown fixes are not representative of the distance.

Q. There are two high altitude ILS approaches to the same runway at a certain Air Force airpatch. The PAR decision heights on the two plates differ by 100 feet. Which is correct?





By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

A. Only the phantom knows. Not really, the approach designer knows. At USAF bases, approach design is the responsibility of the Air Force Communications Service Squadron. Get in touch with them on the phone and let them know that something is wrong. An error such as this would necessitate that a NOTAM be sent listing the correct decision height. The folks who design the approaches and those who do the graphics do an excellent job, but as humanoids, they can err. Another fellow called one day and told us that the localizer frequency was not published on a back course localizer approach. That would make it kind of hard to fly wouldn't it? Thought about studying the approach during preflight planning lately?

Q. I have seen dead reckoning segments on approach plates, SIDs, and STARs. Should I apply a drift correction to attempt to fly the depicted course, or just fly the heading?

A. Apply any known drift correction so as to fly the depicted course over the ground. The guy who designed the approach, SID or STAR has figured obstacle and terrain clearances using the ground course. Although the amount of protected airspace is enlarged for dead reckoning segments, we can fly more safely by attempting to fly the course.

Q. OK, I'm going to apply any known wind correction on those DR segments. Where should I get the wind information so I can figure a drift correction?

A. A Doppler or inertial drift obtained from on-board equipment would be the best. Since some of us don't have that equipment in our flying machines, consider the following:

- Estimated wind from a previous leg.
- Wind obtained from pilot to forecaster.
- Forecast wind from preflight weather briefing.
- If operating near the surface, the wind given by ATIS, approach control or tower.

Q. The ILS chapter in AFM 51-37 includes, "If the glide slope warning flag appears, or glide scope indicator deflection in excess of one dot (half scale) fly-up occurs after intercepting the glide slope, the approach should be flown no lower than the published localizer minimum descent altitude." My questions are (1) what does fly-up mean, and (2) if I get more than one dot below the glide slope and subsequently recapture and get back on the glide slope, can I continue descent to decision height rather than to localizer minimums?

A. First, a fly-up indication tells you that you are below the glide path and that you must fly-up to get back on it. The answer to the second part of your question is yes. However, if you get more than one dot below the glide slope, when you are below localizer minimums, your wheels may be dragging in the trees.

Q. Prior to change 3 to AFM 51-37, I could continue an ILS to decision height with anything less than full scale glide slope deflection. Why did that change?

A. Once upon a time some Air Force pilots were flying multiple ILS approaches. Since the weather was good, the pilot that wasn't on the gauges was spending most of the time looking outside so as not to collide with any other heavier (or lighter) than air vehicles that might be traversing the area. Said he, "Hark, we seem to be quite close to the trees." They were. The flight inspection people from Air Force Communications Service were called in to investigate. After flying several ILS approaches on different days, they discovered that the glide slope beam was bending down toward the ground. "Hark," said they, "if we let pilots fly near full scale below the glide slope during the times when atmospheric conditions are causing the beam to deflect downward, they may drag their wheels in the trees." Seriously, that is what actually happened. Aircraft with large distances between the aircraft's ILS antenna and the bottom of the wheels are the most susceptible to this danger. However, since AFM 51-37 is written for all aircraft, it was changed to make it a little safer for all of us.

In summary, if you discover something questionable or wrong on an instrument approach procedure plate, call the Communications Squadron at that base and ask for clarification. USAFIFC will answer any questions that you have about pilot procedures/directives or about the approach design book, AFM 55-9. Please keep your questions coming. If we don't know what you don't know, we don't know what to put in these articles. For TERPS, call AUTOVON 487-4274. For pilot procedures/directives, call AUTOVON 487-4276/4484. ★



TEST FLIGHT ... TH

GROVER "TED" TATE
BDM Corporation
Edwards AFB CA

"After all of the analyses, tunnel tests, simulations, ground tests, training, planning and discussions have been completed, the moment of truth arrives and the test pilot must face the execution of flight tests that he recognizes as difficult and dangerous in spite of all of the preparations. Continuing on, notwithstanding these risks, he exercises the final requisite which is born of governed apprehension—COURAGE."

Richard M. Wenzell,
Pilots Handbook for
Critical and Exploratory
Flight Testing.

"There was a rather noisy bang, a cloud of black smoke, we yawed somewhat to the right, there was light flame about the nr 4 engine and the smell of fuel inside the aircraft. I retarded power on all engines, executed the recommended emergency procedures and returned to the airfield without further incident." This was how B. A. Erickson, test pilot supreme, described an engine failure during a B-58 test flight.

I stared at him in astonishment, for I had been in the seat behind him during the incident and that wasn't the way that it happened at all. We were doing test runs at Mach 2 at 45,000 feet when nr 4 engine turbine wheel broke loose and crashed through the cowling. The wheel came inboard toward us, raking the protective steel cover of the flight control package. Great



E ARENA OF TRUTH

chunks of heavy cowling structural parts peppered the aircraft like attacking enemy flak. One heavy gauge piece about 2 feet long penetrated the lower surface of the wing fuel tank and JP-4 flowed over the aircraft like a waterfall. The sky around us turned black as the fuel spilled over the tail pipes of the hot engines and we boiled in the heavy smoke. The aircraft swung violently to the right as if some giant hand had suddenly grabbed the wingtip. Even with close fitted oxygen masks the smell of raw fuel and exhaust fumes within the aircraft was stifling. A great mushroom of bright orange flame surrounded the stricken nr 4 engine and threatened the entire fuel soaked aircraft. It seemed to be the end of that aircraft so I got ready to eject—ready in all respects, mechanical, physical, and spiritual.

Ejection was not to be that day, for just as he said, Mr. Erickson brought the aircraft under control and we landed safely at home base. During the debriefing after the flight I declined comment, because after hearing Mr. Erickson's description of the flight, I decided that we really were not in the same aircraft.

Flights like this are those that make flight test programs fascinating, and test pilots a special breed of low key hero. Granted, this wasn't the every day typical test flight, but it was typical of the stimulating events that periodically punctuate the routine. It was typical of the expertise exercised by competent, trained and well disciplined test pilots during test programs. Not all incidents turn out as well as this B-58 story, and test crews are often taxed to pay the supreme dues for probing the unknown. With modern technology, computers, and realistic simulators the incidence of catastrophic inflight failure has diminished—but it has not always been that way.

My admiration for test pilots started back in the 30's with Gable and Arlen and Bogart. It grew with all of the drama of the screen and bumped nose-to-nose with reality about 36 years ago in 1940. After a stint as a "rag boy" with Glenn L. Martin Co, I was elevated to airborne grease monkey and got to fly my first test flight with Captain Thomas L. Taylor in the short wing Martin Marauder. From that beginning with this magnificent pilot I was always privileged to fly with excellent test pilots. There weren't too many test pilots around in the 1941 era; but I always seemed to luck out and get to fly with the really good ones.

There were pilots like Roland Sansbury, Ken Ebel, Carl and Mel Hartley, Henry Myers, Ellis D. Shannon, Denny Morelock and Pat

TEST FLIGHT THE ARENA OF TRUTH

continued

Tibbs. Carl Hartley and Hank Myers were killed during the B-26 program but all of the others lived on to become chief pilots, board members, airline captains, etc. Mr. Shannon in later years became the first man to fly a delta winged aircraft—the Convair XF-92.

While flying in the old B-26 "Widow Maker" or "Prostitute" (no visible means of support), I experienced almost every known inflight emergency and always escaped relatively unscathed. There were jammed flight controls, ruptured accumulators, inflight fires, engine failures, runaway props, failed electrical systems, gun interrupters that didn't work, flaps that jammed, gear-up landings, no-brake landings, hatches that blew off, and all sorts of minor aggravations, but somehow the pilots always delivered us home in one piece.



From the late Gen Al Boyd, first commander of AFFTC, and the early B-58 test program to Col Joe Cotton, Lt Col Fitz Fulton and the XB-70 to today, the men who make the test flights write aviation history.



Among the flying mechanics, or "aerial engineers", there was an obvious hero worship for the test pilots that was often more pronounced for one pilot than another. Carl Hartley was the epitome of the glamour test pilots. With the pink pants of the old Air Corps, the leather A-2 jacket, the neat scarf and the yellow pigskin gloves, he always looked as if he was ready to do the love scene with Carole Lombard or Irene Dunne. We all loved this guy, his appearance, his dramatic flying, and particularly the way he always treated us as equals. It was several days before any of the mechs would touch a B-26 after Carl Hartley was killed in one. For awhile the airplane was regarded as an assassin—one who had taken something precious from each of us.

After a stint in the Big War, I flew a part of the B-36 and XC-99 programs. Here again the excitement of flight test flourished, although the total B-36 program was a rather docile one. There were moments when the routine was infrequently shattered by explosive decompression, fuel leaks, all engines quitting simultaneously, engine fires, stuck landing gears, lightning strikes, bird strikes, loss of all electrical power, and miscellaneous other problems.

One XC-99 flight created enough excitement and used up enough adrenalin to make up for the relative calm of the B-36. Through a series of personal, personnel, and equipment problems we wound up with a burned out aux power unit, a gaping hole in the rudder, gigantic wheel well doors blown off, rup-

tured hydraulic lines dangling in the breeze bleeding red oil like blood from a wounded giant, broken windows, no pressurization, limited flight instruments, and a bright red unsafe landing gear warning light. After making a visual check to assure that the gear was locked, we landed to discover that we had no brakes or prop reversal. We finally came to a stop off the runway—appropriately very close to an adjoining cemetery. Once again, through the skill of the test pilot, "we had defied death and won."

All of those flight test programs were only the ghosts of programs past, and a subtle prelude to that of the B-58. Here was a program that was a pilot's challenge—after all of the practice, the gates opened and the real bull invaded the arena.

During the 50 years following the Wright Brothers' flight we had progressed from their craft to a bomber capable of high subsonic speed and then suddenly, with the B-58, we more than doubled that speed. Fifty-three years of progress compressed into a short flight test program. Compress and double we did—but not without paying a very high price.

The test pilots on the B-58 program were great. No helmet and goggles but with hard hat and pressure suit they demonstrated their skill and courage in developing the Mach 2 B-58 from an idea to an operational aircraft. There were B. A. Erickson, Doc Witchell, George Davis, Ray Tenhoff, Jack Baldridge, Ray Fitzgerald, Val Prahl, Gen Al Boyd, Gen Guy Townsend and Lt Col Fitz Fulton. I would have paid to get to fly with those guys. The radical advance from subsonic to double sonic was demanding and it extracted its toll—Ray Fitzgerald, Ray Tenhoff and Jack Baldridge were killed during test flights of the B-58 and the other pilots survived an unbelievable matrix of incidents and accidents.

It seemed that everything that could happen to an airplane happened during this program. With eye witness participation on the coattails of the pilots who flew it, my admiration for them grew to greater proportions. Incidents like the one quoted in the beginning of this story were almost daily events and the pilots coped with them to make the aircraft a success.

During flights with Doc Witchell, we landed at Kirtland AFB with a heavy airplane and no brakes, got into violent pitch oscillations at Mach 1.6, blew all 16 main tires and had a magnificent fire during a landing, had a Chinese New Year on-board electrical short during a night takeoff, had a bomb pod hit the aircraft after release, and a host of lesser events. With Jack Baldridge we had an on-board fire that knocked out all nav and communications equipment and then had to penetrate a squall line to get back home (at night).

Another time we had an auto ILS signal virtually roll the aircraft at 1500 feet. With Ray Fitzgerald and a guest general aboard, at Mach 2 we got a random roll signal that created an unidentified supersonic maneuver that exceeded the published aircraft structural limits. With Gen Boyd there was a drag chute and fuel dump probe dropout and engine failure on the way to Mach 2. With George Davis there was a failed windshield and gear drop at Mach 2. There were hung weapon pods, exploding batteries, hardover flight control inputs, non-predicted supersonic gyrations, unlocked hatches and all of the lesser events regarded as routine. Each time, the pilot did a great job of bringing the aircraft home.

In the F-111 program I had limited exposure, but one flight with Fred Voorhies, a real cool "cajun pilot", was typical of the professionalism of the test pilot. We had, by plan, dropped a 600-gallon pylon fuel tank from the aircraft only to have it return to angrily attack us. It hit the underside of the aft fuselage, knocked out the right engine, ruptured the fuel tank, started a fire and inflicted structural damage. I was ready to depart via the escape system but Mr. Voorhies calmly and quietly landed the aircraft on the dry lake bed at Edwards AFB. A multi-million dollars saved.

We are inundated with a flow of tributes to all who have contributed to our 200th anniversary as a nation, and I think we should throw a few bouquets to the guys who carried aviation from infancy to the dominant world influence that it enjoys today. Coincidentally, this year is the 20th Annual Banquet and Symposium of the Society of Experimental Test Pilots and I say "HAPPY ANNIVERSARY." Surely, Ray Tenhoff, Dick Johnson, John Fitzpatrick, Scott Crossfield, Tom Kilagraff and Joe Ozien, who started the whole thing should be honored.

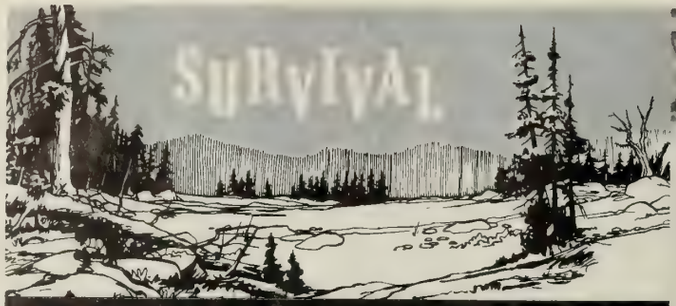
TEST PILOTS ARE MY FAVORITE PEOPLE—AND I ALWAYS CALL THEM "SIR." ★



ABOUT THE AUTHOR

Grover "Ted" Tate spent many years as a flight test engineer and retired from the Air Force Reserve in which he served as a navigator. Ted has been a frequent contributor over the years to **Aerospace Safety** and other USAF safety magazines. His consuming interest in survival led him to write frequently on the subject. Generally the article was based on some Tate experiment such as bailing out of an airplane in Death Valley in the summer and surviving—even with a broken ankle.

His interest in Death Valley and desert survival took him to the ghost town of Ballarat. The result was **The Ballads of Ballarat,** a seldom seen, slim volume of verse, one of the few copies of which, no doubt, resides in the editor's desk drawer.—Ed.



Killer Of The Unprepared

SGT ALLAN L. BOBST
Programs and Current Operations
3636th Combat Crew Training Wing
Fairchild AFB WA



More and more we hear about people dying of a condition called hypothermia. Exactly what is hypothermia and why is it called "Killer of the Unprepared?" What can I do to combat it? The techniques outlined below will apply in any case and can save your life.

Two most basic factors in the prevention of cold injury are the heat producing capacity of the body and the effectiveness of the measures to conserve this heat. Hypothermia results when the body's core temperature is lowered because the body is unable to produce enough heat to keep up with the losses.

In acute accidental hypothermia, the loss of heat from the body's vital core can result in uncontrollable shivering, followed by increasing clumsiness, loss of judgment, and a fairly rapid descent into unconsciousness and death.

What then are the conditions that cause accidental hypothermia? In cases affecting mountaineers and outdoorsmen, a combination of four factors is likely to be present:

- Cold (not necessarily extreme).
- Wetness (caused by rain, melting snow, immersion or even condensed perspiration).
- Wind (which vastly increases the chilling effect of the coldness and wetness).
- A likely victim (meaning a person who is possibly exhausted and is certainly unprepared to protect himself).

Adequate clothing, adequate knowledge, emergency shelter and emergency rations would prevent most fatalities from accidental hypothermia. This is the reason why it is called "Killer of the Unprepared."

HEAT PRODUCTION Food and muscular activity are the chief sources of body heat. When resting and awake, the body produces heat at a specific rate known as the basal metabolic rate. The metabolic rate can be elevated by such natural hormones as thyroxin and adrenalin, by diseases which produce a fever, and physical activity.

Intense shivering can produce heat approximately equivalent to running at a slow pace. Moderate exercise, such as hiking up a trail with a heavy pack, can increase heat production up to ten times the basal metabolic rate. During sleep, heat production drops to 80 percent of the basal rate. External sources of heat include sun and fire and the immediate warming effects of hot liquids. Intake of hot liquids is important in the prevention and treatment of hypothermia.

HEAT LOSS Radiation is a leading cause of heat loss in almost any situation, and the head is the most efficient portion of the body's radiation system. An unprotected head may lose up to one-half the body's total heat production at 40 degrees Fahrenheit; up to three-quarters of the total body heat production at 5 degrees.

The body continually warms a thin layer of air next to the skin to a temperature nearly equal to that of the skin. If this warm air layer is retained close to the body by clothing, we remain warm. However, if this warm layer of air is constantly being removed by a brisk wind (convection) we feel cool and put on more clothing. The wind chill chart is reproduced to remind you of the devastating effects wind can have on your body.

Everyone notes with awe that at

−50° and 33 knots wind speed the equivalent chill factor is −130°. But note the chill factor for a comfortable plus 20° and a 16 knot wind (not too uncommon conditions anywhere in the US). Suddenly you're faced with a chill factor of −10°.

In short, the primary function of clothing is to retain that layer of warmed air close to the body and, if worn properly, to prevent hypothermia.

The evaporation of perspiration or other water from the skin and lungs accounts for a substantial loss of body heat.

Inhaling cool air and exhaling warm air accounts for a significant loss. But there is very little that we can do to prevent it.

The thermal conductivity of water is 240 times as great as that of still air. This means that wet clothing can extract heat from your body up to 240 times as fast as dry clothing. It is worth noting that the wicking action of wet wool is considerably less than that of other fabrics. Wool can provide some warmth even when wet.

Inevitably, if heat loss continues, the temperature of the body's inner core will begin to fall below 99 degrees. As core (internal) temperature drops, symptoms are as follows:

99 to 96°: Shivering becomes intense and uncontrollable.

95 to 91°: Violent shivering persists. Difficulty in speaking, sluggish thinking and amnesia start to appear.

90 to 86°: Shivering decreases and is replaced by strong muscular rigidity.

85 to 81°: Victim becomes irrational, loses contact with environment and drifts into stupor. Pulse and respiration are slowed.

80 to 78°: Unconsciousness.

Below 78°: Usually failure of cardiac and respiratory control centers in the brain, followed by death.

The primary purpose of this article is to warn you to be prepared for the cold-wet-windy situations which can kill you. Preparation and prevention consist of six essential factors:

- Know your enemy.
- Dress for warmth, wind and wet.
- Eat! Keep nibbling.
- Carry emergency bivouac gear.
- Bivouac early.
- Keep active.

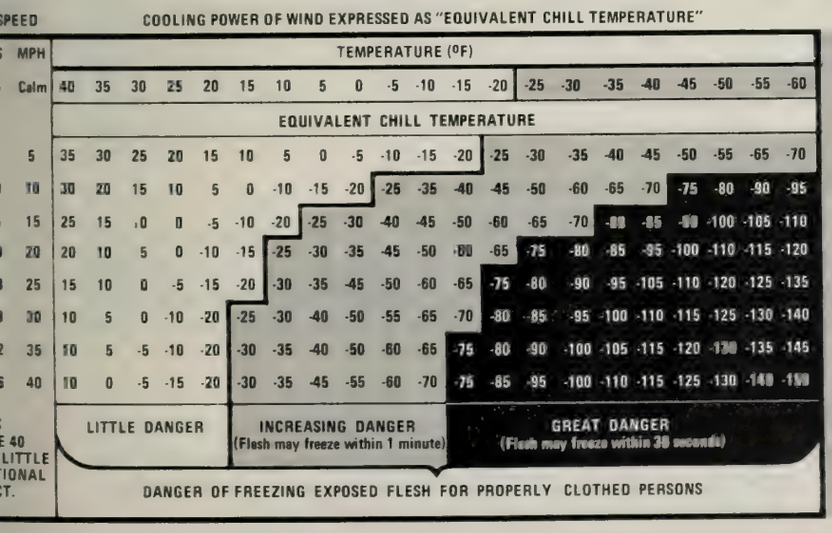
Treatment for hypothermia is as follows:

- Prevent any further heat loss.
- Add heat to rewarm the victim's body.
- Place the victim out of the wind and in the best available shelter.
- Replace his wet clothing with dry clothing.
- Place as much insulation as you can between the victim and the ground.

Placing a hypothermia victim in a cold sleeping bag, no matter how much down it contains, is not sufficient. The bag should be prewarmed by another member of the party who has stripped down to his underclothing in order to transfer a maximum amount of heat from his body to the bag. Ideally if the bag is large enough, place the victim in the bag with the other person.

If the patient is conscious, he should be given warmed fluids. If he is able to eat, he should be fed candy or sweetened foods; carbohydrates are the fuel most quickly transformed into heat and energy.

In summary, the treatment of acute hypothermia in the field is to get the patient out of the wind, replace his wet clothing with dry, insulate him from the ground, and warm him by the most expedient means available. ★



SPEED — COOLING POWER OF WIND EXPRESSED AS "EQUIVALENT CHILL TEMPERATURE"

MPH	TEMPERATURE (°F)																				
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-60
	EQUIVALENT CHILL TEMPERATURE																				
5	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-65	-70
10	30	20	15	10	5	0	-10	-15	-20	-25	-35	-40	-45	-50	-60	-65	-70	-75	-80	-90	-95
15	25	15	10	0	-5	-10	-20	-25	-30	-40	-45	-50	-60	-65	-70	-80	-85	-90	-100	-105	-110
20	20	10	5	0	-10	-15	-25	-30	-35	-45	-50	-60	-65	-75	-80	-85	-95	-100	-110	-115	-120
25	15	10	0	-5	-15	-20	-30	-35	-45	-50	-60	-65	-75	-80	-90	-95	-105	-110	-120	-125	-135
30	10	5	0	-10	-20	-25	-30	-40	-50	-55	-65	-70	-80	-85	-95	-100	-110	-115	-125	-130	-140
35	10	5	-5	-10	-20	-30	-35	-40	-50	-60	-65	-75	-80	-90	-100	-105	-115	-120	-130	-135	-145
40	10	0	-5	-15	-20	-30	-35	-45	-55	-60	-70	-75	-85	-95	-100	-110	-115	-125	-130	-140	-150

LITTLE DANGER | INCREASING DANGER (Flesh may freeze within 1 minute) | GREAT DANGER (Flesh may freeze within 30 seconds)

DANGER OF FREEZING EXPOSED FLESH FOR PROPERLY CLOTHED PERSONS

INSTRUCTIONS

Measure local temperature and wind speed, if possible; if not, **estimate** enter table at closest 5°F interval along the top and with appropriate wind speed along left side. Intersection gives approximate equivalent chill temperature. That is, the temperature that would cause the same rate of cooling under calm conditions.

NOTES

WIND
1. This table was constructed using miles per hour (mph); however, a scale giving the equivalent range in knots has been included on the chart to facilitate its use with either unit.
2. Wind may be calm but freezing danger great if person is exposed in a moving vehicle, under helicopter rotors in propeller blast, etc. It is the rate of relative air movement that counts and the cooling effect is the same whether you are moving through the air or it is blowing past you.
3. Effect of wind will be less if a person has even slight protection for exposed parts. Light gloves on hands, parka hood shielding face, etc.

ACTIVITY — Danger is less if subject is active. A man produces about 100 WATTS (341 BTUs) of heat standing still but up to 1000 WATTS (3413 BTUs) in vigorous activity like cross-country skiing.

PROPER USE OF CLOTHING and ADEQUATE DIET are both important.

COMMON SENSE — There is no substitute for it. The table serves only as a guide to the cooling effect of the wind on bare flesh when the person is first exposed. General body cooling and many other factors affect the risk of freezing injury.

OPS TOPICS

BIENNIAL FLIGHT CHECK

If you have an FAA pilot's certificate you must have a flight review every 24 months. For military pilots this normally isn't a problem since the annual 60-1 checks fulfill the requirement. However, as more and more pilots find themselves "flying a desk" the FAA check becomes important. Remember, if you have not had either a 60-1 check or an FAA flight review within the last two years, you cannot legally fly as a pilot (see Part 61 of the FAR's).

A MESSAGE FOR THE HIGH ROLLER

When a warning device is actuated, the odds clearly favor impending danger with respect to the warning, *not* . . . the probability of a faulty warning device. To wit—

> At 1000 feet AGL, the firewarning light illuminated. The throttle was retarded and the light extinguished. A visual check of the engine revealed no evidence of smoke or flames. The throttle was then advanced to a high rpm. The fire light did not illuminate, however, sparks were observed coming from the cowling. The engine was then shut down.

Readvancing the throttle on an engine after a malfunction warning, particularly fire—is risking half a million dollars, needlessly. Burned out circuits will not mend themselves! Disprove the danger *before* you disprove the warning.

TURBINE WHEEL FAILURE

A T-33 was forced to make a flameout landing as a result of a turbine wheel failure. The crew did a good job on the recovery; and on this flight no limits or regulations were violated. However, the turbine failure was typical of the type caused by over-temperature and overstress. This is one more example of the absolute necessity for observing engine operating limits. It gets very quiet at 35,000 when the engine quits.

LOW EPR

The B-52 pilot was completing the after takeoff checklist. As the flaps were coming up the nr 5 fire warning light came on. After flight maintenance found that the spider duct assembly had ruptured. During takeoff, the pilot had noticed that the nr 5 engine EPR was slightly lower than normal. But since he thought this was the result of only partial water on this engine, continued the takeoff knowing they had dry capability. It is not uncommon in the case of bleed air leak for the EPR to be low. If the crew had known this and then had checked on the low EPR, maybe a lot of firewall repair could have been prevented.

SLUSH + COLD = ICE

A B-57 could not get the nose gear down because slush thrown into the wheel well during taxi froze at altitude. Not to be outdone, a T-37 attempted the same trick and was just as successful. The major difference between the T-37 and the B-57 was that the T-37 was able to use the speed brake as a support for the fuselage.

INSTRUMENT HOOD FIRE

A T-33 instrument hood had a 3-inch hole burned in it. This is another instance of sunlight magnified by the canopy burning the hood. The unit has forwarded information on the problem to the ALC. But until a fix is approved, be careful about leaving instrument hoods in the T-Bird.

OPS TOPICS

COULD NOT DUPLICATE

A B-52 could not be fixed because maintenance could not determine the cause of the malfunction. Why couldn't they determine the cause? The aircrew's write-up was too vague and incomplete. Maintenance performed all the checks they could without success, but were unable to question the aircrew due to schedule conflicts. None of us like to be disturbed on our time off, but it's no better to find the airplane down because maintenance could not decipher the pilot's write up. We are all in a hurry after a mission; but take the time to *adequately and completely* write up any discrepancies. If you have doubts about the information needed, ask to have a specialist meet you at the aircraft. If we, the aircrew, want quality maintenance, we must do our part by really telling it like it is.

F-4 ANTISKID

The following is a quote from an F-4 FCF pilot's hazard report. "I completed an FCF high speed taxi check to test the new antiskid system installed. The new system worked beautifully but had such a different feel that I believe that an aircrew that is used to the old system may misinterpret the lack of any antiskid cycling to be an indication of an antiskid failure and cause him to 'paddle it off' just when he needs it most. This lack of any antiskid feel by cycling would be especially confusing during the transition when some aircraft are modified and some are not."

WHAT IF HE WAS IMC?

On a radar vector to a precision approach to a naval air station in VMC, a P-3 pilot was given a descent from 4500 feet to 2000 feet. Approaching 3300 feet, the pilot decided that 2000 feet provided insufficient clearance for the mountain ridge directly ahead. Therefore, he leveled at 3300 feet and cleared the ridge by 500 feet.

The approach controller had mistakenly given a premature descent. Fortunately, the VMC weather prevented a disaster. Nonetheless, the important message here is that the pilot must always be aware of minimum terrain clearances and sector altitudes when operating at low altitudes. (Controllers don't often make mistakes but when they do it could ruin your whole day if you aren't prepared). This case adapted from NAVSAFECEN Weekly Summary nr 35-76.

"TOO MUCH TROUBLE?"

After completing a practice firing run, the HH-53 crew collected the expended brass and unexpended ammo and sealed it in ammo boxes. The boxes were then thrown out of the aircraft from the rear ramp. When the fourth box was thrown overboard the lid flew off and struck the tail rotor. Fortunately, the damage was minor and the crew was able to make a precautionary landing on a deserted road. The reason given by the crew for dumping the boxes was that turning in the ammunition and brass was "too much trouble."

BUGS BUNNY WON'T HOP AGAIN

On the fourth approach after three touch and go's the T-33 crew could not get the right main gear down. All attempts to get a safe indication were unsuccessful; and after landing, the right main collapsed. During the investigation the outer gear door was found jammed between the inner door and the wing. There were remains of a rabbit on the outer door. Evidently during a touch and go the aircraft struck a rabbit. The impact weakened or broke the forward outer door attach bracket. This allowed the airloads after takeoff to pull the door loose and jam the gear.

OPS TOPICS

VMC?/VERTIGO!

The helicopter pilot was attempting to fly at tactical altitude (tree top level). However, it was a very dark night with marginal weather (rain, low vis and ceiling). Guess what? The pilot got vertigo and hit the ground.

BENT FLAP

When the RF-4 pilot lowered the flaps during the initial ground check, the leading edge flap indicator showed a barber pole condition as the flaps stopped at the one-half position. The crew chief checked for abnormalities but could find none. The pilot then cycled the flaps again. This time as the flaps retracted, the left outboard leading edge segment did not retract, and the left center segment struck it causing some minor damage. The flap bellcrank was broken at the connection to the actuator rod. Cycling the flaps two or three times with a malfunction is not recommended when on the ground—it may cause further damage.

LIGHTS HELP

The F-111 departed the IP for a low level bomb run. The weather was IMC with the aircraft in and out of clouds. The pilot's attention was caught by a bright light similar to a landing light at 3 o'clock, co-altitude. He then saw wing tip lights and a rotating beacon, and started immediate evasive action. Although he lost sight of the traffic during the maneuver, he estimated a proximity of less than 1 mile! Suppose the other aircraft had not been using a bright light?

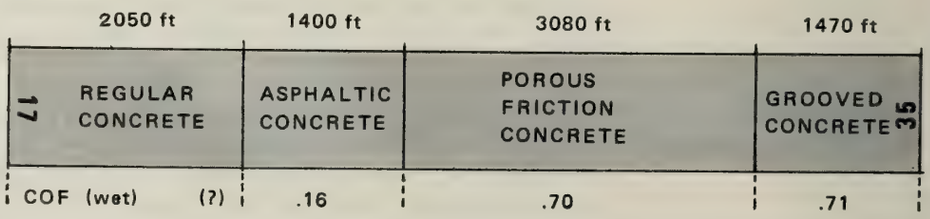
CHECK YOUR PUBS

During preflight, the pilot discovered that a FLIP Letdown book was missing *31 pages*. The book had been assembled with the pages missing. Fortunately there was no problem; but it could have been hairy if discovered airborne in the weather. It pays to check before you go.

PFC

NAS Dallas runway 17/35 has an experimental porous friction surface (a special porous asphalt aggregate overlay which allows water to drain through it). This surface drastically increases the coefficient of friction and thus braking action. The problem is that this rapid change can cause blown tires. A T-39 landed at Navy Dallas with a coefficient of friction (COF) of .16 (poor). The aircraft immediately began to hydroplane. When the aircraft crossed onto the porous friction surface, the COF changed from .16 to .70. The main gear tires immediately blew out.

The following graph of coefficients of friction for NAS Dallas was published by the NAVSAFECEN in the *Weekly Summary of Major Aircraft Accidents* (for more information on runway surfaces see Captain Burke's article "Runway Surface Hazards" in this issue). ★



COF (dry) The average for the last three sections of Runway 17 is from .74 to .76.
No COF was available for the regular concrete since that was not part of the experiment.



CUTTING THE ACCIDENT BILL

MAJOR THOMAS R. ALLOCCA
Directorate of Aerospace Safety

People cause accidents and these accidents involve a substantial loss of USAF resources. In fact, in the 10-year period from 1966 through 1975, there was a $1 billion loss incurred in those aircraft accidents where human error was cited as causal. One billion dollars!

People differ greatly. At the ball park or the beach on any hot summer day, even the most casual observer cannot help but be impressed with the amazing array of physical differences among people. But people differ in a myriad of other less easily determined characteristics—qualities such as intelligence, trainability, interests and motivation.

These two facts—that people cause accidents and that people are different—concern those of us in the accident prevention business (and that's all of us), particularly when we seek to identify measures which will lead to a reduction in human factor-caused accidents.

The aircraft dollar loss figures mentioned earlier involve systems which include the F-4, C-141 and the B-52. These are man-machine systems in the classic sense; that is, they are equipment systems in which one of the components is a human who interacts with the machine component during operation of the system. If we are to prevent accidents with these systems, then we must consider their major subsystems—man and machine—and the interface of the two.

The machine (or hardware) subsystem must receive a significant portion of the safety effort—and it does. Air Force accident files are filled with actions we've taken to minimize the hardware-failure input to the accident sequence.

. . . there's really no way to predict the infinite variety of responses man takers of the full consequences of their actions.

We've done everything from complete systems redesign to major fleet modifications.

But how about the man? The accident statistic mentioned earlier supports the contention that the human subsystem is also worthy of our efforts. Human factors deals with the human subsystem and attempts to minimize man's contribution to the accident sequence. Three primary areas on which human factors concentrate are: design of equipment, selection of people, and training of people.

Human factors-types are the first to grant that people make mistakes. In fact, the "to err is human" thing has been used so often it has become a part of our vernacular. But, when human factors engineers look at the human error "goofs", they raise some crucial questions, such as: "Can part of the blame be found in the design of the equipment that people use?" "Do certain kinds of equipment become involved in more mishaps than others?" "Can we redesign a piece of equipment in such a manner that the possibility of human error is minimized?" The answer to these and similar questions is a resounding "yes!" And, in all fairness to the human factors engineering community, remarkable strides have been made redesigning machines for man-machine compatibility.

During the design phase, the human factors engineer considers such things as machine displays, controls and working environment so that they are "in tune" with man's natural abilities. This is not easily done; man is the most complex of beings and a program attempting to design equipment that is compatible with man's natural characteristics is ambitious at best, impossible at worst. But the pervasiveness of the field—human factors types are employed in every branch of the armed services, in government, in the aviation, electronic and automotive industries—strongly suggests that we are making substantial strides in this area. How about the selection process?

To answer this question, let's consider the task of selecting, from a number of applicants, one person to do a particular job. To make the proper selection, psychologists insist that a number of questions must first be answered—questions such as: "What aspects of this job must be taken into account for defining those human characteristics needed to do the job?" "How should we analyze this job?" "What kinds of behavior constitute successful job performance?" The answers to these and similar questions will undoubtedly prove helpful in job placement and selection, but I suggest that, for accident prevention purposes, we need continuously to ask—in spite of past failures—questions such as: "What methods should be used to 'size up' or measure the tendency for USAF pilots to become involved in accidents?" "What evidence shows adequately the relationships between certain measured human characteristics and involvement in USAF accidents?" "What identifiable human qualities can be introduced into a battery of tests which will help establish some measure of accident proneness?"

I submit that we've addressed the first group of questions fairly adequately; USAF's classification and assignment system has (and I know you're going to mention the Ph.D. mathematician who was assigned to the gym) done remarkably well in properly placing the thousands who join our ranks each year. But what about the second group of questions? This is the group most germane to this discussion.

In making the selection or assignment decision, two kinds of error are possible—an individual is assigned to a job on which he fails, or an individual is not placed on a job in which he would have been successful. For our purposes, only the first error is of concern. If, for example, a pilot is given an F-15 assignment and becomes involved in a pilot-caused F-15 mishap, or if an airman is assigned as a C-5 engine specialist and becomes involved in a human error-caused C-5 engine-related mishap and if, through proper selection procedures, both of the human

ıke in a given situation . . . we must somehow apprise the potential risk-

factor aspects of these accidents may have been predicted with a reasonable degree of accuracy, we seriously missed the boat. The relative cost of both of these "wrong" decisions far outweighs any expenditures we could have made in improving our selection procedures. Maybe such a selection program is not possible; maybe humans are so complex that "there's no way" to accurately predict their behavior (especially accident-proneness); but is it worth a try? You bet! Now let's briefly discuss training.

Training programs in the Air Force are widespread. In fact, a large part of our day-to-day existence involves training. We train people to modify their knowledge, skills and attitudes in order that they may perform their jobs better. Now personnel selection and job placement are inextricably intertwined with job training. If we select and place people perfectly, our training problems are substantially decreased. But we don't select and place people perfectly, so it becomes necessary to base selection and placement partly on the basis of what training can achieve and to select people who are most "trainable." But here also, as in the selection process, we must include in our training programs a proper appreciation for accident prevention. Do we? I think not.

Even a cursory review of USAF mishaps indicates that in 1976 humans make the same general kinds of mistakes they made in 1966; failure to follow prescribed procedures; insufficient attention to a potentially hazardous situation; incorrect diagnosis of a situation. Can we design a training program that will ensure that a pilot will not land in weather known to be below minimums, or that a flight line mechanic, by not following tech order procedures, will install an engine filter backwards? Probably not—there's really no way to predict the infinite variety of responses man will make in a given situation.

Both examples cited above have a common cause: "risk-taking." The flight line mechanic was probably trained satisfactorily; he probably knew how to do the job. Furthermore, he undoubtedly knew he was supposed to follow tech order procedures—but he didn't! The pilot's mistake also involved risk-taking; he, too, was properly trained; he knew he should not attempt the landing, but he did it anyway. He made the decision, by himself, to take a chance. The human factors question is: "Why do we engage in risk-taking?" For, if we agree that risk-taking differs from confidence, then we can state that it's not a desired characteristic in people working in and around airplanes. Somehow we've got to get this across to the risk-takers. Can training do this? Perhaps.

The Air Force conducts excellent training programs for aircrew, maintenance and support specialists; the training problem, therefore, is not one of quality—it's one of emphasis. We must somehow apprise the potential risk-takers of the full consequences of their actions. This should be done in such a way that the potential risk-takers believe what they're being taught. Why? Because the most effective control of their actions must be self-generated; that is, they'll most effectively exercise self-discipline when they are convinced it's in their best interests to do so. Is this self-generated control an easy thing to teach? Hardly. But, as with the selection question, it's certainly worthy of our best efforts.

In summary, then, if we are to appreciably change USAF's human factor-caused accident losses, we must make a concerted effort to identify those new or novel courses of action which will lead to such a reduction. This discussion has suggested that these approaches should address the selection and training processes, but to significantly reduce that $1 billion figure will require many new ideas in many new areas. I've repeated the words new and novel with purpose—the conventional approaches have been tried and have achieved some success—but the time is ripe for some different ideas. Help! ★

Don't Put The Blame On Mame

MAJOR RONALD L. DeCOSMO
Directorate of Aerospace Safety

Someday, you could be asked to provide testimony before a board, or officer, investigating an Air Force mishap in accordance with Air Force Regulation 127-4. Perhaps you or a friend are directly involved in the mishap. In either case, you might feel you are between the proverbial "rock and a hard place. . . ." You know it's vital for the Air Force to determine causes to prevent future occurrences; yet, you don't want to point the finger at yourself or a friend. If you ever find yourself in this position, the following thoughts may help put this dilemma in perspective.

The crux of the Air Force accident investigating/reporting process *is not* to place blame for mishaps. Rather, the thrust is to determine *what* can be done to prevent future mishaps and *who* can do it. Certainly, we need to determine who was involved in a mishap and how, but this information is only important as a means of finding ways to prevent future occurrences.

The Air Force commitment to this philosophy is evidence by the existence of "privileged information" and the privileged nature of nuclear, aircraft and missile mishaps. Air Force Regulation 127-4 provides the specifics; however, the key points are that mishap investigations are for the sole purpose of preventing accidents—nothing else. Second, the regulation recognizes that frank and open communication with people involved in mishaps is vital. Therefore, confidentiality and immunity are granted to anyone who provides information to flight and missile mishap investigations. In short, it can't be held against you.

Unfortunately, at the Air Force Inspection and Safety Center, we often see individuals and/or organizations preoccupied with trying to point, or avoid, the finger of blame for mishaps. They are missing the point. Who was involved and how they were involved are only a means to an end. The end is what can be done to prevent future mishaps and who can accomplish it! ★

MAIL CALL

Thank you very much for the beautiful job your staff did in publishing my article "From Fighter to Airlift" in your August '76 issue. The art work done by Mr. Baer, is beautiful and really adds that crowning touch to an article which I hope all aviation people will enjoy. We have done a sequel, after ten months flying the C-130 and I will, hopefully, be able to send you a copy in the very near future. Thanks again for your great article.

P. K. Wood, M.D.
Flight Surgeon
Ohio Air National Guards
Mansfield Lahm Airport
Mansfield, Ohio

I have read with interest Major Harrison's article "Life Support Discipline." Discipline with life support equipment and procedures is as important as that required for all aspects of flight. The probability of making an ejection, bailout, or emergency ground egress should be considered just as other emergency procedures such as a fire light and hydraulic failure are. "Life Support Discipline" is an integral part of "Flight Discipline." It should be exercised from the pre-mission briefing through engine shutdown.

I do disagree with one point. The majority of aircrews who are conscientious of life support training and equipment are not necessarily comprised of those who have "been there." A sizeable portion, if not the majority, of aircrews I have worked with are adequately concerned with the safety and well being of their bodies in flight. Sometimes, however, what concerns them does not seem to be high on the list of our considerations in life support thinking. Some are concerned that when we increase the weight and bulk of the helmet by adding a dual visor they will not be able to adequately "check six." They know/feel that this added restriction may cause them to put that life support discipline to work sooner than necessary. They don't know when an F-4 Jock/Gator has demonstrated a need for that dual visor! They do not know who has put this requirement on them. They do feel that whoever it was has not spent a great deal of time in the combat environment of their cockpits.

"Look realistically at what is provided?" Yes—at *all* levels.

TSgt Rudolph J. Buday
91TFS Life Support

Your letter was referred to the author who replied as follows:

"All items of life support equipment are initially generated by one source—the user . . . (generally because of) lessons learned through accident investigations and combat mishap reports. . . .

"In the specific concern over the dual visor requirement, please keep in mind that dual visors are listed as an aircrew option and only made mandatory in certain MAJCOMs, wings, or squadrons by the direction of that organization's 'Director of Operations.' In our experience, most DOs fly right along with the other jocks, so to say these decisions are made by inexperienced individuals, is an invalid accusation." ★

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IED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



STAFF SERGEANT

Michael A. Moseley

920th Weather Reconnaissance Group
Keesler Air Force Base, Mississippi

On 14 January 1976, Sergeant Moseley, an Air Force Reserve Crew chief on a WC-130H aircraft, was standing by his aircraft awaiting the arrival of a fuel truck. As the truck approached, he spotted smoke and then flames emerging from beneath the pump portion of the 4500 gallon tanker truck. The driver of the truck, unaware of the spreading flames, continued into position midway between two aircrart, just 10 feet from the wing tips. Sergeant Moseley, disregarding the possibility of explosion, rushed to the fuel truck, warned the driver of the fire, and grabbed the truck's portable fire extinguisher. In minutes he had the flames under control, but the danger had not completely passed. Sparks from what looked like the truck's braking system were still visible from the underbelly of the truck. He continued to contain the sparks until the fire department arrived a few minutes later. Sergeant Moseley's immediate response to this dangerous situation prevented the loss of a fuel truck, and possibly two C-130H aircraft and the lives of the individuals in the area. WELL DONE! ★

NEW SAFETY TROPHY



Does your unit qualify? There are plaques for Flight, Explosives, Missile and Nuclear Safety. The criteria for selection are in AFR 900-26, "Safety Awards."

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CORRECTION

The last sentence of the article "Thunderstorm? Cumulonimbus?" which appeared on page 1 of the September issue should be changed to read: "Aircrews should take the same precautions when briefed about cumulonimbus as they do when briefed about thunderstorms."

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

SUBSCRIPTION—AEROSPACE SAFETY is available on subscription for $10.35 per year domestic; $12.95 foreign; 90¢ per copy, through the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished. Use of funds for printing this publication has been approved by Headquarters, United States Air Force, Department of Defense, Washington, D.C. Facts, testimony and conclusions of aircraft accidents printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the Aerospace Safety Magazine. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, Aerospace Safety Magazine, Air Force Inspection and Safety Center, Norton Air Force Base, California, 92409. The Editor reserves the right to make any editorial change in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from AEROSPACE SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will insure complete accuracy of material, amended in light of most recent developments. The contents of this magazine are informative and should not be construed as regulations, technical orders or directives unless so stated.

DECEMBER 1976 AFRP 127-2 VOLUME 32 NUMBER 12

Be Where You Say You Are



The Library of the

CAPTAIN JERRY E. WALKER • 86th Flying Training Squadron • Laughlin AFB TX

FEB 2 1977
University of Illinois
at Urbana-Champaign

Have you ever fudged a little bit on altitude reports while climbing or descending under Air Traffic Control? Well, if you've done it consider yourself lucky. If you are doing it or considering it, you are endangering yourself and jeopardizing the lives of others. Air Traffic Controllers never ask for altitude reports unless a possible traffic conflict exists. In order to allow for adequate altitude separation, it is imperative that all pilots report positions and altitudes with the utmost accuracy and integrity.

Consider this situation and the pilot's action which caused the situation. A C-130 pilot was holding over an NDB in preparation for an ILS approach. The C-130 was cleared for the approach and the pilot began a descent from 3000 MSL in a procedure turn. While the aircraft was descending to 2100 MSL, the procedure turn completion altitude, a PA 28 Tri-Pacer was transiting the area. The pilot of the light aircraft requested radar advisories and reported that his altitude was 2800 MSL.

Approach Control advised the Tri-Pacer that he had a C-130 5 miles from his position, and the pilot of the Tri-Pacer acknowledged that he had the C-130 in sight. The C-130 pilots were advised of the Tri-Pacer's presence and that the pilot of the Tri-Pacer had the C-130 in sight. The C-130 turned inbound to intercept the localizer course. At this time the C-130 flight crew began looking for the light aircraft.

When the Tri-Pacer was within 600 feet of the C-130 it was spotted in the 12 o'clock position by the Flight Engineer. Both aircraft were at the same altitude 2100 MSL. This altitude was confirmed by the right seat pilot who was administering the left seater an annual instrument evaluation. The C-130 took immediate evasive action and cleared the Tri-Pacer by approximately 300 feet. Luckily, the C-130 was at approach speed and saw the Tri-Pacer in time to avoid a disaster. If the C-130 had been at penetration airspeed, a midair collision probably would have occurred.

This incident could have been prevented if the pilot of the Tri-Pacer had accurately reported his altitude as 2100 MSL. The Tri-Pacer pilot's lack of integrity almost cost his life and possibly the lives of the C-130 aircrew. We military pilots certainly fly aircraft with higher airspeeds; and the potential for midair collisions is steadily increasing. The new altitude encoding altimeters relieve us from the need to report altitudes in most cases. Needless to say, equipment will fail and situations will arise in which accurate reports will be necessary. Our integrity must certainly match the highest of professional standards and we must continue to watch for the other guy. ★

1976
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DESTINATIONS
FLIGHT CREW CHECKLISTS
HOW TO FLY
XSC-1
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"If Santa Claus Can Do It..."

MAJOR JACK SPEY
475th Air Base Wing

For years around Christmas time I've wondered how Santa Claus managed to fly an overloaded sleigh and nine unruly reindeer from house-to-house, accident-free, or at least nonreportable, and circumnavigate the globe at 900 kts plus; and doing all this reportedly without practice flights, route checks, or any preflight planning that pilots perform routinely.

This year, my curiosity being even more aroused, I asked John, an intel friend of mine, to help me determine if Santa in fact flew any local transition flights around the Pole. Did he have any mock-up rooftops built for touch and go's? Was he flying the route at other times of the year and using sophisticated jamming gear to fly undetected? John, having little else to do (John's a specialist on Liechtenstein) leaped at the challenge, and a large scale effort was launched. Using all possible means of collection and analysis, John soon assured me that Santa flies no locals, the reindeer are barned for 363 days each year, the sleigh is hangared for the same period and Santa spends the year making toys.

"Making toys! Huh. Even Santa has additional duties? How does he stay current?"

John, my intel type, went on to say that at 10 p.m. each night, before retiring, Santa was observed sitting quietly alone in front of the fire, and apparently, just meditating. He makes no sound or lip movement so the Bug and TV implants can shed no light on Santa's thoughts.

After John's report, I was still faced with a quandary. How was Santa Claus, who's primary job was making toys, with an additional duty of flying (and only once a year at that), able to perform flawlessly each year under the most difficult conditions?

My mind was unable to think anymore so I put the whole problem aside. Anyway, I had mountains of paperwork to attend to before Christmas, and I was scheduled to fly the next day.

The next day, the 22nd of December, I was to fly the southbound courier, RON, and return on the 23rd. No sweat! A cold front had passed through the Washington area on the night of the 21st so the weather for the flight was clear and a million.

That morning it was Field Grade Weather—a clear, cloudless winter sky. The preflight was routine, the takeoff smooth, and the southbound leg was effortless. After landing, however, the Red Cap Oil sample revealed that the left engine had to be changed. The turbine oil assayed higher than the ore from the Old Glory Mine in Virginia City. And I was about to miss Christmas!

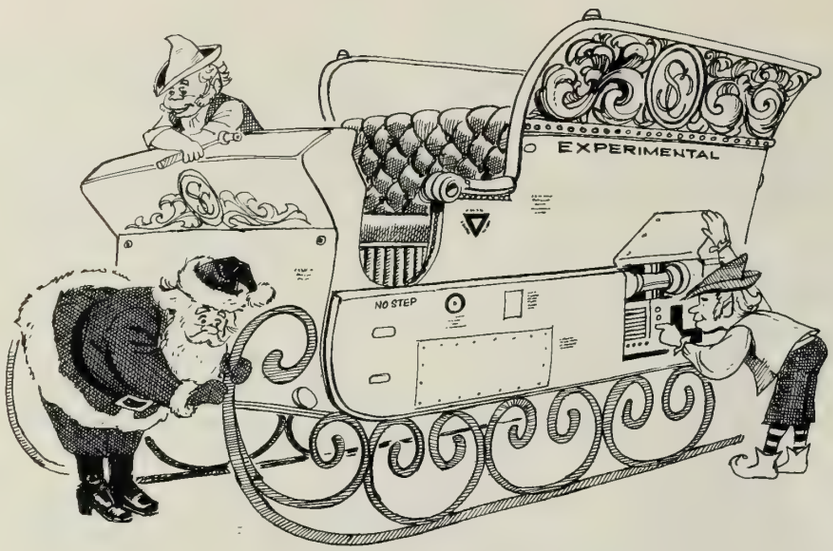
The 23rd was spent killing time while the engine was being changed. You know the type of day: the club for breakfast, the BX, and a golf game with Mike, the Director of Ops. He's a classmate and we're both Rippy Eight.

On the 24th, Capt Jim Russell, my copilot, and I took off for home. But during the delay for the engine change, a low pressure system moved in and had covered Home Plate with snow. And my desk, by this time, would be equally smothered in paperwork, and there was still the unsolved question concerning Santa Claus.

The flight home on Christmas Eve was great until crossing Richmond VORTAC where we caught up with the weather. You guessed it! A good old low pressure area to descend through, with 400 overcast, snow, and 1½ miles visibility awaiting us. (ATIS revealed that the RCR machine engaged the barrier at 30 kts.) As we were handed off to Approach Control, wouldn't you know it—the left generator blew.

At this point, all I'm concerned about is Christmas presents, an overgrossed in-basket, shoveling the sidewalk, and the $64 I lost to Mike playing golf, in addition to the generator light, low vis, and RCR. I remember mumbling something like: "Jim, check that generator and get out the checklist." And I recall slowly fading behind the Saberliner's problem as she sliced toward home. I also remember telling myself, "you can handle this airplane," while slowly drifting farther and farther behind the problem.

Walking toward the car, I complimented Jim for his handling of the emergency and the assistance



he gave me during the approach and landing. As we parted, I recall thinking how far behind the aircraft I had fallen due to forgotten knowledge and a mind full of other matters. I'm glad Jim was aboard.

Christmas Eve was wonderful. Marilyn and the children were jubilant that Dad had made it home in time. As I settled into bed, the phone rang. It was John at the Intel Shop.

"Sir, I'm sorry to bother you but I thought you might like to have our latest on the Santa Claus operation."

"Yeah, John, go ahead."

"OK, sir. Starting the evening of 21 December, Santa spent four hours in what appeared to be flight planning. He had all sorts of charts laid out, and maps covered the floor. He worked till 0200. On 22 December, starting at 1800, Santa went through the same routine and finished work at 0130. On 23 December, at 0700 Santa personally inspected the sleigh, survival gear, and chute. He finished preflight at 1030 and spent the rest of the day going over maps and weather charts. He worked till 0030.

This morning Santa awoke at 1100. He supervised the harnessing of the reindeer. At 1400, he ate a large high-protein, low-residue meal. But then we lost contact with the Bugs and sensors due to problems with the satellite.

"In conclusion, sir, Santa spent 29 hours in intensive preflight planning, and personally conducted a comprehensive preflight inspection. For 4 full days his total mental effort seems to have been directed towards tonight's flight. Any questions, sir?"

"No, John, but I sure appreciate all you've done. I've learned all I need to know. Thanks again, and have a merry Christmas and a safe New Year."

"You're welcome, sir. Merry Christmas." ★

Making The

MAJOR PHILIP M. McATEE
Directorate of
Aerospace Safety

When was the last time yo stopped by the comm sho to talk with the technicia who is working on that intermitte UHF you wrote up? Or did you g over and see how the flight co trol team is coming with troubl shooting that roll problem you ha with 795 yesterday?

What we're talking about is yo (the crew member) getting to kno the maintenance people and hel ing them to help you. Now I r alize I'm not talking to all cre members; many of you enjoy e cellent rapport with the maint nance troops.

Remember when we used have squadron concept of maint nance for the fighters or when yo airlift folks were on the road wi a maintenance team, and the e cellent maintenance support yo received? Why do you think th was so? It was because the mai tenance folks felt a part of th operation. They could see wh mission they were supportin Union cards went out the windo and everyone pitched in to get th job done. The maintenance peop got to know the aircrews and vi

eam



ersa. Also, they saw that they ere important to the big picture.

Now we know that it takes more eople to run squadron mainteance. In these days of budget uts we no longer can afford it. ut what happens to these same aintenance men and women hen they are back at their home ases absorbed in the big AMS, MS, MMS and OMS squadrons? oo often the rapport is lost. The aintenance folks are doing the ame job but now they have lost heir identity as a part of the team.

Aircrews go their way and the aintenance types go theirs.

Everyone likes to have other eople take an interest in his job nd that goes doubly for the inhop specialist. At least the line rew chiefs have involvement with he flight crews, but the in-shop epair specialist rarely see the rews at all, just their write-ups. hey lose a sense of belonging to the team."

Now there are many ways a nit can stimulate this rapport and eeling of involvement. In one unit he crew members were assigned s advisors to each shop in the aintenance complex. These crew members acted as a "big brother" to the people assigned to that shop. They would visit the shop frequently and brief what was going on and the operational results from their side of the house. They would answer questions, discuss mutual problems and, in general, serve as a go-between and feedback loop between ops and that shop.

I really don't feel that such a formal program is necessary. It is just as effective for crews to stop in the shop and talk about what was done on a particular job or how a really difficult write-up is coming. The few minutes spent in these visits give the maintenance folks a tremendous boost and increased dedication because **you** are interested in their work.

This doesn't take a lot of time. Simply following up on your write-ups will probably give you quite a bit of maintenance exposure. Not only are you increasing the morale of the support folks, but you can also greatly increase your knowledge and understanding of your aircraft, its equipment and what makes the whole thing tick. And that's good. ★



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DOVER AFB	Dover, DE
GRIFFIS AFB	Rome, NY
KI SAWYER AFB	Gwinn, MI
REESE AFB	Lubbock, TX
VANCE AFB	Enid, OK

OPS TOPICS

PUT ON YOUR MASK

A T-33 was on a navigation proficiency flight at FL 370 when the backseater told the pilot he was going to remove his oxygen mask to blow his nose. Approximately two minutes later, the pilot was unable to get the backseater to respond to intercom. The pilot saw that the backseater's mask was still removed and he was looking dazed. The pilot told him to put his mask on. Receiving no response, he declared an emergency, descended, and diverted to the nearest Air Force base. The cabin altitude prior to descent was 23,000 feet. Later, fully recovered on the ground, the backseater said that he took his mask off to blow his nose, then noticed that he had dropped his pencil. He recovered his pencil, then decided to fill out the form 70, still with mask off. He remembers looking out, thinking how nice it was and how relaxed he felt. He heard the pilot talking to him; but he couldn't concentrate on what he was being asked to do.

IT WAS JUST A BAD DAY

The engine start and ground checks were completed normally and the F-4 was ready to taxi when the WSO told the pilot that there was heavy blue smoke billowing from around the rudder pedals. The IP in the front seat ordered ground egress, shut down the engines and climbed out. The WSO made an emergency ground egress and fractured his heel when he jumped to the ground.

This was the WSO's second ride in the F-4. Maintenance could find no malfunctions and the most probable explanation is fog from the air conditioning vents.

A SLIP FROM THE SWITCH

As the THUD jock completed his before taxi checklist, he checked the landing gear downlock override switch with his thumb while holding the landing gear handle down with his other fingers. There would have been no problem except that one finger slipped off the gear handle and actuated the arresting hook switch. In one sense this pilot is lucky. The external stores jettison switch is in the same area. He could have hit that instead. The check the pilot was performing is no longer in the pilot's checklist (for some fairly good reasons).

TRANSIENTS—BE ALERT

A southern base has reported serious problems with transient aircraft. This base has been forced to curtail transient maintenance operating hours because of reduced manpower. The new hours have been published in the NOTAMs but aircraft continue to arrive outside the transient services operating hours.

While this is a problem in itself, there are more serious aspects. These include attempts at unassisted taxiing, parking, and even servicing by aircrews. Granted, many crews are qualified to perform these functions, but the violations that have occurred have the potential for disaster. There is no excuse for marshalling an aircraft at night without lighted wands, no fire guards for start or performing maintenance during refueling.

No aircraft commander should tolerate such practices around his aircraft. And as a footnote: One of the things you certify when you sign that DD-175 is that your base of intended landing has appropriate *maintenance support to safely complete the mission.*

OPS TOPICS

RECIPE FOR A TAXI ACCIDENT

First, have civil engineers work on the parallel taxiway using barricades to mark the work area. Add some confusion between CE, Base Ops, and tower about just where this construction is located. Then make sure that the barricades used are white and position them on the white painted area of the taxiway.

Once this is ready, take an A-7 pilot taxiing in from a mission. Make sure the HUD combining glass is fogged over, and have the pilot more concerned about locating his parking space than clearing the area immediately in front of his aircraft. Result: one SLUF with a slightly bent nose.

NEW PIREP FORMAT

A new nationwide standardized PIREP format was implemented October 15 by the Federal Aviation Administration, National Weather Service and Department of Defense. When pilots make in-flight weather reports, however, they need not follow the new format. The information they transmit to FAA air traffic and flight service facilities is encoded into the format by ground personnel. After becoming familiar with the format, pilots may want to use it when making reports in order to pass the information along more expeditiously and efficiently.

Under the standardized format, a PIREP will be identified by the letters UA at the beginning of the report. The order in which the data will be encoded is:

OV (location); FL (flight level); TP (type of aircraft);
SK (sky cover); TA (temperature); WV (winds);
TB (turbulence); IC (icing); RM (remarks).

HOW TO ZAP TA

After the RF-4 landed the pilot did not jettison the drag chute and he did not release it after shutting down the engines in the transient parking area. The crew then left the aircraft *but did not install the canopy initiator pin.* When TA tried to remove the drag chute they discovered it was still installed. A technician climbed up and reached into the cockpit to jettison the chute. Unfortunately, he grabbed the wrong handle and jettisoned the canopy. While obviously the technician was wrong, the aircrew did not help much. It is bad enough to be lax with after-landing procedures at home drome where everyone knows the aircraft, but at other bases where people don't know your airplane as well, you *have* to be sure everything is done correctly, or else

AERO CLUB ACCIDENTS

There has been an alarming number of Aero Club accidents this year. There are no surprises in the cause factors:

- Flight below authorized terrain clearance limits.
- Loss of control during landing.
- Fuel starvation.
- Inadequate knowledge of aircraft systems and emergency procedures.
- Inadequate pilot checkout and familiarization in a new aircraft.
- Failure to comply with FAA aircraft inspection directives.

In every case the accidents could have been prevented by a more professional, disciplined approach to flying activities. Flying general aviation aircraft requires the same attention to detail as flying a military aircraft.

OPS TOPICS

BAD DAY ALL AROUND!

The right throttle of the F-4 became stiff just after takeoff. With the right throttle still set at mil power, the rpm rolled back to 80 percent. The pilot retarded the throttle to idle; and the rpm stabilized there. Since everything seemed to be working, the throttle was advanced to mil again. The engine responded normally but a "check hydraulic gauges" light came on and utility hydraulic pressure dropped to 1000 psi. An attempt was made to lower the gear but only the nose gear came down and locked. All three gear indicated down and locked when the emergency system was used. Next, the right generator failed. The right engine was operating normally at that time, but shortly thereafter the throttle again stuck at about 99-100 percent. The throttle finally came loose but the engine would not reduce below 95 percent. The pilot planned an approach end engagement, lowered the hook, and used the emergency system to blow the flaps down. The touchdown was good, about 800 feet short of the cable. Unfortunately, the hook did not engage. The emergency brakes were activated and a successful engagement was made at the departure end. Neither the throttle nor the engine master had any effect when the pilot tried to shut down the right engine. Engine shop technicians shut down the engine by disconnecting the throttle linkage and manually moving the throttle linkage arm to cut off. The cause of this mass of problems was a bleed air duct failure which allowed hot air to damage the throttle linkage, wire bundles, and hydraulic lines in the right engine bay.

BLACK HOLE

A C-9 approaching an East Coast air station late on a particularly dark and hazy evening was advised that the field was VFR and to expect to land on the short runway (6000 feet) because the main instrument runway (7000 feet) was closed for resurfacing. As the aircraft crossed the 5-mile DME point, Approach Control advised that the main runway had just been opened to traffic. With the winds light and variable, the aircraft commander elected to use it.

Due to the last minute runway change, the aircraft arrived on final approach slightly high and fast. Corrections were made and the aircraft crossed the threshold at the desired height and speed. As the pilot began to rotate into the flare, with all four landing lights illuminated, he suddenly realized that the runway surface was totally invisible. A fresh coat of black asphalt had been laid and runway markings had not yet been painted. The blackness of the new surface, immersed in a totally black background obliterated all visual reference to the ground. Aircraft height and pitch references were lost. As the aircraft commander began to initiate a go-around, the aircraft touched the invisible surface, and the landing was completed without further incident.

A pilot has to experience an event only once to realize how much he depends on runway markings to judge height and pitch attitude. In this case, no NOTAM had been issued due to lack of a standard NOTAM code for runway markings. The operations duty officer, not being an aviator, had no knowledge and little understanding of the hazard. Of course, steps were taken to properly advise subsequent arriving night flights of the hidden hazard. From NAVSAFECEN Summary 37-76 ★

Winter Flying... Seasonal Work



CAPTAIN
JOHN E. RICHARDSON
Directorate of
Aerospace Safety

Winter brings both good and bad news for pilots. First the good news: Southern California is less smoggy, and you no longer have to achieve earth escape velocity to top the thunderstorms in Texas and Oklahoma.

Despite those helpful items, for most of us, winter has much more bad news than good. Of course, if you happen to be stationed at Kincheloe or Elmendorf, you have long since checked out on winter flying. But the rest of us do need a refresher on winter.

Let's start with the airplane. When was the last time you looked back in that section of the Dash One on cold weather operations? Many aircraft have special procedures for operating in cold weather. For example, some engines and instruments must be warmed up before operation. Batteries that are not in good shape may totally give up when the temperature gets in the minus category. This, combined with leaking seals and stuck actuators, can be very frustrating.

One of the nice things about winter flying is the increased thrust your engines develop in cold weather. Gone are those long adrenalin producing takeoff rolls. Yet, this is a mixed blessing. If you are not prepared, the additional thrust can produce unusual pitch angles and the more rapid acceleration can overspeed gear and flaps.

Finally, a note on ice and deicing. If you have your aircraft deiced, be sure that fluid has not drained into the flight control areas where it can freeze. Many aircraft have special procedures for deicing. Have the maintenance people at your base show you.

The airplane is important, winter or summer, but no matter how good the airplane, the pilot must be prepared also. How long has it been since you really did any serious instrument practice. Flying a super GCA in CAVU "field grade" weather is no sweat. Could you do it as well in 200 and ½? A smart pilot gets ready for winter by reviewing AFM 51-37 procedures and then by getting in some simulator practice. Not everything you need for winter flying can be practiced in the simulator. Short final at night is no time to review your wet/slippery runway procedures.

Once you get yourself and your airplane in shape you still have one more problem—the weather. You don't have to be stationed at Minot to be concerned about snow and ice. Suppose you plan a cross country from Bergstrom to George. If you take a look at the map you will see that you fly over some of the most rugged terrain in the United States. It gets quite cold at 10,000 feet in the Sangre de Christo mountains. Although the chance of an ejection or forced landing is remote, you should plan and dress for the eventuality. Another practical aspect of dress is the possibility of diversion. It is unpleasant to land at Buckley with only a summer flight suit when the chill factor is minus 40°.

Although the thunderstorms are gone, weather is still a problem. The jet stream is stronger and farther south. It is not unusual to find 100 knot winds at cruise altitude. This can significantly change fuel planning figures. You can avoid embarrassment by checking the winds aloft before you go. (Speaking of winds —they can also be a problem at the surface in some areas.) Winter is the time of the mountain waves. The turbulence associated with that phenomenon is extremely dangerous.

The real secret to successful winter flying is planning. If you have carefully preplanned your mission, and considered the possibilities and problems you won't be surprised by an unexpected turn of events. Planning is even more important now when we get fewer hours and less experience. With your help the Air Force can enjoy an accident-free winter flying season. ★



LEARNING BY DOING

CAPTAIN ROBERT M. HAIL, 28 BMW, Ellsworth AFB SD

During the years of 1968 and 1969 the war in Southeast Asia was at its peak. The Air Force needed many pilots to sustain its offensive and defensive corps of pilots. In this era is when the FAIP (First Assigned Instructor Pilot) truly came into his own. "Experienced" pilots were used, for the most part, as the firstline pilots. But, someone had to train the pilot of the future, the UPT student. This is where the FAIP comes into the picture. A FAIP in general terms was a good stick and rudder man, had a degree of good judgment, and was basically thought of as an adequate, but yet to be proven, IP (instructor pilot).

My story starts in the fall of 1969. I entered UPT at Randolph AFB, TX. The year proceeded as a normal UPT year, long hours, hurry up and wait, pressure to excel, and to "fly and fight and don't forget it."

I had no difficulty at all in the flying phases of training. For that reason, I finished in the upper part of my class. I received my orders to Pilot Instructor Training TDY enroute to my permanent duty station, and obtained 65 hours of flight time plus the usual academics. They put you in the instructor's seat and taught you how to fly from there. A few techniques, a few "watch out for's," several check rides to ensure proficiency, and presto—a new instructor.

I reported to my PCS base with less than 300 hours total flying time. I was given, as are all new IPs, several orientation rides in different phases of instruction, to ensure that I had had adequate training and was ready to assume my role in the instructor force.

You then are assigned to a flight. The students in the flight are senior and in the last phases of the course, if at all possible.

Your student pilots are average or above, to allow you to build up the needed experience with the least amount of close calls. These close calls can be with the ground or other aircraft by allowing the student to fly beyond his abilities, and maybe yours.

Now I am ready, I've had all the training, the orientations and a few student rides. I want to be a good IP, therefore I explain maneuvers to the student flying and try not to keep my hands and too much pressure on the stick.

AN AEROSPACE SAFETY

I WAS THERE



I have been an IP for almost three weeks now. We are in the four-ship formation phase. It is early in the phase, about the fourth ride and my student would like to take some movies of the flight for future references and for retrospect. I agreed to allow the movies and we briefed on when and where he is to take them and the proper procedures we will use to exchange aircraft control. We then met with the other three IPs and their students. The flight was briefed per the checklist and everything was normal. Since I was the newest IP and my student was only average, we were assigned the nr four position.

The atmosphere was good, it was the last flight of the day for all of us. With an instructor in each of the aircraft, we could get some good "work" done.

Takeoff was normal and the formation proceeded to the area for wing work and rejoin practice. My student was taking movies intermittently throughout the climb, level off, and some wing work.

I was flying well so the student could see where the position to be flown was and how the formation worked as one.

After the student had finished taking movies, I told him to stow his camera. I repeated myself three or four times to ensure it was secured and would not interfere with the controls. This action was very important for me in the accident investigation.

Once I was content with his stowing of the camera, we exchanged control of the aircraft. The student flew 5 to 10 minutes and was doing fairly well staying in position. We were now doing wing work, climbing and descending turns. A shallow descending right turn was transitioning to a shallow left descending turn when it happened.

Number three was riding high on the lead aircraft and my student was riding high on number three. I had been trying to get him to push forward on the stick to get down. This pushing forward seems very out of place when first learning to fly formation. When the left

turn was indicated, number three popped up high and my student followed his lead. All of a sudden, the four ship was out of his sight. I could see them just over the canopy rail. I took the aircraft and corrected. The combination of our being high, requiring less than one "G" to recover and the formation descending to the left, gave sufficient G to dislodge the student's camera. The camera, which had been stowed between his legs instead of his side pockets or the map case, "floated" up and struck the canopy.

The canopy failed and plexiglass "exploded" outward. The front canopy had only about 15 square inches left intact. I broke away from the formation and called "out." At this time I was pushing on the stick to increase our rate of descent. We had been at 18,000 ft before the decompression and I wanted to get the aircraft to 10,000 ft quickly.

I recovered to level flight and was heading back to base when the right engine failed. The noise was tremendous. I could hardly talk to my student in the front seat, let alone over the radios. I told him to run his seat full down and keep his hands on his lap to keep them out of the airstream. I called "in the blind" that I was returning to base, that I had lost an engine, and that my pitot static instruments were erratic, because of the loss of pressurization.

Number three saw us and tried to rejoin. After making one pass he rejoined. I could hear and talk enough to explain my emergency and told him to lead back because of my poor communications and instrument readings.

I returned to base, made an uneventful landing, and had the honor of being met at the end of the runway by the wing commander. Earlier that day he had given us his "glad to be here at my new base and take command speech."

SECONDARY EMERGENCY—STRESSES

After the explosion of the canopy I reacted as any well-trained pilot. I ensured that I had control of the aircraft, descended because of the decompression, took care of my failed engine, and pointed the aircraft towards home. All of this taking place in a matter of seconds.

Now comes the reaction stresses, or as I call it, the "secondary emergency." Here I am, a second lieutenant, I've been an instructor for 2½ weeks, have just over 300 hours flying time, and now I've broken an aircraft on the wing commander's first day. The only think that could make it worse is if the other engine quits and we have to bail out and lose the aircraft totally.

The mind is a wonderful machine. It can quickly analyze a situation, take proper action and in this case leave you 15 minutes to worry about what they are going to do with you.

I have already had the explosion and reacted, I've lost an engine and descended to reduce decompression effects and get the aircraft flying properly. I am heading towards base with communication problems and instrument fluctuations. I am now following the aircraft who put me into the position which caused the situation. Now I am set. The hardest part is over, or is it? All I have to do now is land. Wrong! Now I have to relive the incident two or three times on the way back, try to fly off of another aircraft, listen to radios as best I can, so if worst come to worst, I can get back without him. I have to figure out position from the field to stay oriented, airspeeds to land at. Of course, the most important problem now is, "what are they going to do to me now?"

"I've been an instructor for 2½ weeks, have just over 300 hours flying time, and now I've broken an aircraft on the wing commander's first day."



By the time I get back to base and land, I've had two PCS moves, an F.E.B. (Flight Evaluation Board) and have ended my career before it has begun. I know that it is always the pilot's fault and if you are training a student "it is" the IPs fault.

At this time, I have recovered from the secondary emergency. I have convinced myself I took care of the emergency properly, I am going to land and save most of the bird, and that is what I practice

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emergency procedures for, in case it happens some day. For me it just happened earlier than most.

All of my fears were answered. The wing commander met me at the runway, walked by me to look at the aircraft, and then walked back to ask "What the hell happened?"

As I had assumed, my flying duties were reduced to zero for 3 weeks, with me working in the squadron commander's office on "odd" jobs. After the investigation was all over, they came to me. My squadron commander congratulated me on a fine bit of flying, bringing back the aircraft, but how did I let myself get there in the first place—"Don't you know better?"

A little more residual training and back into the fire I went, a little more experienced.

IDEAS ABOUT FAIPS

Time required FAIPS during the war years. At one time my squadron was 60-65 percent FAIP during 1970-72. Now it is still 55 percent.

The idea of making IPs out of good flying students is valid. But a risk is involved here as anywhere. This risk is putting low time, inexperienced pilots or IPs into a high risk or high exposure repetitive situation.

I do believe that the new man should continue training on the job —buddy IP flights, etc. The more time and experience he can obtain, the better he will be.

Now that there is no great demand for FAIPS, the number should go down. Let him go out into the real world and get his experience.

I do believe, in my case, that the experience I gained as a young IP made me more aware. I could relate better to the student because we weren't far apart in years and our experiences were similar. I was a buffer between the SEA returnees and the students, trying to keep both perspectives in the real world.

There will be FAIPS who have adjusted and have earned their way; also some weak ones. We have to help as best we can with their shortcomings. Together, maybe we can all fly well and safely through the total effort. ★

SITUATION AWARENESS *One key to safety*

CAPTAIN LARRY KANASTER, Kunsan AB Korea



Situation awareness on the part of individuals can play a major role in decreasing accidents and accident potential. All accidents are related by one factor—the individual(s) involved was not aware of the potential for the accident or chose to ignore the "warnings" for the accident. This is "situation awareness."

Let's relate this first to flying. All pilots were taught basic aerobatics. Take the aileron roll—few of us would label this maneuver as dangerous (type aircraft not withstanding). We perform such a maneuver with plenty of altitude, airspeed, in VMC conditions, and so forth so that it is a "safe" maneuver; if we dishout or stall, our altitude acts as our safety cushion. Now what if we do the same maneuver immediately after takeoff? Is it still the same "safe" maneuver? The answer is maybe! For example, many flight demonstration team solos have done just such a maneuver routinely with few accidents associated with it. The reason: total situation awareness throughout the maneuver by the pilot on aircraft position, altitude, attitude, and aircrew proficiency.

The maneuver is not *first* practiced after takeoff, it is worked into gradually. It is practiced with plenty of altitude with the pilot getting used to the timing involved and eventually moving down toward the deck. The pilot is comfortable in the execution of the maneuver and can detect and react to unplanned situations with relative ease. His "situation awareness," or in this case "experience," tells him when to roll, how much to roll, how much and when to unload, and so forth. He would know how much of a "dishout" his aircraft will normally give him and how much he can safely accept. He would quickly detect, say, a lack of engine response while still rolling to a "safe" attitude.

Those of us not accustomed to such a maneuver so close to terra firma would naturally be slower to detect and to react to the same situation. For us the maneuver might be called "dangerous." Why? Because we are maneuvering in an area for which we are unsure of our abilities and our aircraft's capabilities. In other words, our situation awareness is lacking throughout the maneuver.

Suppose we decide to fly such a maneuver anyway. I would bet most pilots flying an aircraft capable of such a maneuver could safely accomplish it—assuming everything goes as planned. Supposing it doesn't go as planned—say we experience a flameout or perhaps our stick-and-rudder abilities this particular day are not up to our usual standards—we have no "out," no cushion. Now if we practice the maneuver at altitude, gradually moving lower and getting used to our reactions *and* the aircraft's, the maneuver becomes safer.

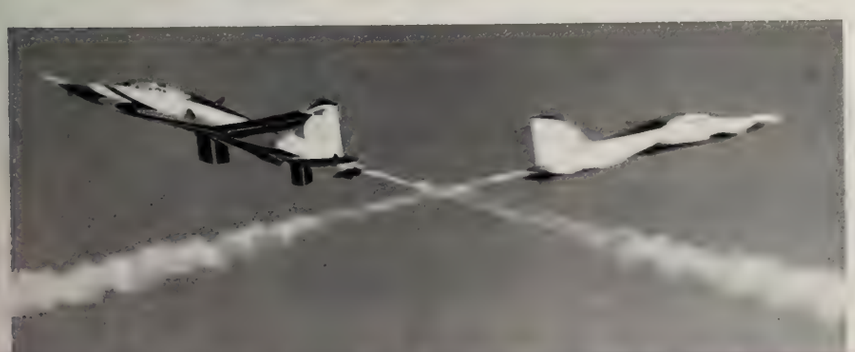
Take another situation—how often have we flown a "lousy" gunnery pass, or loop, or GCA, or just about any maneuver? By "lousy" I don't necessarily mean below "book" standard, but below *our normal* standard. Probably not too often, but often enough. Assuming the aircraft performs as it should, what is the reason? Perhaps it is our proficiency, psychology, crossed biorhythms, or what not, i.e., we're not up to standard at *all* times and in every situation. Thus the "safety pad" comes in! However, we can't always have a pad. For example, an engine failure in an F-100 on takeoff as the gear is coming up leaves little "safety pad" available. We compensate for this by closer attention to engine instruments, emergency procedures, and thoroughly knowing our egress procedures. We know whether we could still land straight ahead or will have to zoom the aircraft and eject. If we land, do we automatically run off the runway or do we go into a barrier? Going off the runway, what might we hit? What barrier is on the departure end and is it set up? Again, *situation awareness.*

Such an example, is or should be, the basis for most all of our training programs. We cannot close our eyes and ears to quoted "dangerous" flying. We must find first the reason why it is dangerous and then either eliminate the maneuver, if it has no potential for us, or train slowly to achieve proficiency in its execution. Proficiency then becomes one of our bywords. But now we have the problem of defining "proficiency."

When is an individual proficient? Is it when our training squares are filled? Is it after 1500 hours in type? Hardly. The answer lies with the individual. Some proficiency is directly related to flight experience —the more times you do it the better you get. But, concurrently, the more times you do it the easier it is to recognize when you are *not* doing it correctly, or when the conditions are such that you probably should not attempt the maneuver at all. This is experience, but a more appropriate term is *situation awareness.* Experience is a term considered as "sometime down the road" by our newer aircrews. After all, how can a second lieutenant or a "slick-winger" be experienced? This is where situation awareness comes in. Instructors, flight leads, old heads—all must talk not merely the maneuver, i.e., *how* to do it, but also *when* to do it (or more appropriately, when *not* to do it). I do not mean our regulation minimums, for in war there are no "minimums" as such. Sure, we can recognize quite easily when not to attempt a particular maneuver at altitude and in peacetime, whether our concern is actually safety or following regulations. But can we recognize this same thing at lower altitude and in wartime? Maybe. But why not work to change that "maybe" to "probably."

Situation awareness can play a major role in reducing our accidents. As we approach any situation we must be aware of the possibility for success and the penalty for failure. If success is not reached, we must also know our alternatives. The risks, then, are either fully acknowledged and accepted or the maneuver is not attempted. At any rate, *situation awareness* has put us far ahead of the game. ★







red flag

The Captain sat quietly beside his wingman during the debrief. He was reflecting upon the engagements he had had that day. All had not gone well. But, being shot down in a simulated combat situation was handy because he saw his errors and was determined, if jumped again by an aggressor, the tide would turn the other way. For the moment he was relaxing and looking forward to the club, hot shower, and downtown Las Vegas. But his thoughts were interrupted by the voice of roll call and the realization that his name had just been mentioned to be a survivor in the next day's scenario.

With some trepidation, he found the survival team chief to ask about the next day's exercise. The team chief made it sound sweet and simple: "Just show up at 0545 and we'll brief you then, and don't go home with the idea that this exercise is going to be rough. Hopefully you'll enjoy it and learn a great deal."

This scene is repeated daily throughout the Red Flag Exercises at Nellis AFB, Nevada. Det 2, 3636 CCTW, at Nellis is charged with conducting the survival aspects of these exercises. The objectives of the scenarios are to give as many crew members as possible the opportunity to experience an SAR effort first hand, to learn by that experience and sometimes by the mistakes made, and to learn what problems can be expected in a survival situation. These problems will be the primary focus of this article. What we are going to highlight are the recurring mistakes we of Survival have observed at Red Flag in the hopes that all aircrews will heed them and give them some thought.

0545 came early and the Captain showed up for the briefing nervous and wishing he were Blue 4 rather than Survivor 1. The briefings went quickly from the total SAR force to the safety briefing by the insert chopper crew, the insert site selection, and finally the individual survivor briefings.

For the survivor briefing, the Captain and one other survivor were assigned to specific survival instructors and they met to go over the equipment found in their seat kits and to discuss the scenario for the day. The Captain was thoroughly



knowledgeable on what each item in his kit was, but a little hazy on just what to do with his URT-33 beacon. When asked what actions he would take with the beacon once on the ground, he stated that he probably would destroy it and bury it. When asked if he was sure about his decision, the Captain had some doubt, but stuck to his guns.

During the scenario briefing he was told that any decision made in the field was his—the instructor was there only to observe and ensure his safety, but he could ask questions and seek advice if necessary. He was, in effect, to pretend that his instructor was not even there and press on as if alone. The instructor would step in and offer instruction or guidance only if it were required to ensure completion of the scenario.

Once the briefings were finished, the Captain gathered his gear and the team proceeded to the insert aircraft. This particular Red Flag exercise was using H-53 Super Jolly Green Giants and the crew chief soon had all their gear stowed and they were ready for takeoff. The flight to the training area was long and boring, but it finally ended with a low-level run-in for insert. The Captain and his instructor deplaned and moved out of the rotor wash. The Jolly departed with a clatter and left a very noticeable silence, but the big green aircraft was soon heard again as it sought the site of its next insert, where the second survivor, his instructor, and a safety observer were to be let out.

The Captain's instructor briefed him on the specifics of his shootdown; where he landed, what condition he was in (he sustained a painful blow to the right wrist upon impact and couldn't move his fingers) also, the fact that enemy activity was close and had seen his chute. Having no further questions, his instructor simply said "Have at it and good luck."

The first item of business was to dispose of the chute. Along with this, the Captain didn't feel he'd need his raft or some other minor equipment, including the URT-33 beacon. So he decided to bury it all right at the site. The ground was very hard and rocky; his next choice was to carry it with him and discard it along the trail when a better concealment site was located. So, with one good arm he picked up his gear and started moving in the general direction of a likely hiding spot. By now he had wasted a good bit of time at the landing site and was in a hurry to move on. Soon, however, he found it difficult to carry the items he wished to discard and make good time. He picked a spot and again tried to bury the "extra gear." Again, no luck. Finally, frustrated, he started to pile rocks on the equipment to conceal it.

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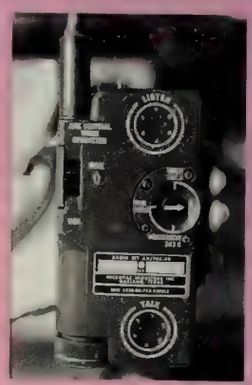
About this time, his instructor stepped up and pointed out a few things. First he had left a very definite set of tracks from the impact point. The ground was hard but the tracks still showed up. Also, by burying his equipment on the trail he was taking precious time, using energy, and worse, definitely convincing the enemy that this was his route of travel. The instructor suggested he just roll up that extra equipment in the brown or green part of the chute and leave it under a bush or rock at the landing site. He further suggested that if he moved carefully and slowly, stepping on rocks or clumps of grass, he wouldn't leave as clear a trail to follow. Thus unburdened, he pressed on.

Once again, he ran into travel problems as he picked the military crest as a travel route—about three-fourths of the way up the ridge line. This route was taught at the Survival School but didn't work well in the desert. It was obvious that there was no vegetation on the hill, so he shifted to a dry creek bed. He was able to use the vegetation and also use terrain masking, thus his route was well concealed.

He found a good hiding spot that was in relatively high terrain and would offer good concealment to the Jolly when he came in to pick him up. His instructor complimented him on his choice of sites and thus bouyed up, he began preparing for rescue. First, he took out his PRC-90 radio and turned it on. Nothing. He couldn't remember if it was supposed to hiss or not, but he assumed that the battery was dead, so he changed it. Still nothing. Suddenly, the cold sweats hit. No radio. Just as suddenly he recalled the URT-33 beacon two miles back under a bush. Now he understood why the instructor had asked that pointed question earlier. His instructor stepped up and discussed the situation and his options — namely the other signaling devices he still had. He got his mirror, flares, gyro jet, even his whistle out and placed them in pockets where they would be easily accessible. Finally, his instructor handed him a spare radio and told him that for training purposes he wanted him to use the radio but in real life he would have been unable to have voice communications with rescue.







Just as he was settling down and enjoying the peace of the area, he heard a jet engine in the distance. Then came the blessed call: "Downed aircrew, this is Sandy Lead . . . over." Establishing contact, he was soon busy, answering Sandy's questions about the area, his condition, known enemy activity, etc. Finally, after three tries, he was able to vector the A-7 directly overhead.

As Sandy departed the area he told the Captain to keep his head down and relax, the Jolly would be there in a couple of minutes. Also, he was given a thorough briefing on how to prepare his smokes and what to do when Jolly came into his area. There followed that interminable wait as the survivor puts all his faith in the SAR forces, hoping and praying they would return.

Shortly after Sandy was out of sight, he spotted a movement on the opposite hillside. He couldn't see for sure who it was but was amazed that at better than half a mile he could hear footsteps, a cough and bits of conversation. Assuming that this was the enemy, he noted their position and route of travel and made ready to warn Jolly when he arrived.

He first spotted the A-7s as they flew cover for the Jolly. Then into the valley came the big green chopper and suddenly things happened fast. The Captain had just given the position of the enemy troops when Sandy called for a mirror flash. He put down his radio and fished out his mirror. Because he was in a bush, he stepped out in the sunlight, then came another transmission, and he had to dive into the bush to answer. Sandy was still calling for mirrors while the Jolly called for a better description of his area and then a hold-down for DF steer. Suddenly, Jolly called for smoke, so once again he set down his radio and grabbed his flare.

The only way he could see to pull the lanyard was with his teeth. But his instructor was quick to point out that by placing a foot on it he

could pull it one handed. In all, about 20 seconds passed before he got the MK-13 flare ignited and smoke finally began to rise. But then he noticed that smoke was also coming from the hillside where the enemy was located. He tried to tell Sandy about this but the radio was busy with talk of a bogus smoke and the Sandy rolling in for strafe. He looked up in time to see the A-7 on a strafing pass on his own position.

It took another five minutes to straighten out who was the real survivor. At last, the chopper was overhead, a PJ came down on the penetrator and helped him on. He then rode the penetrator into the aircraft where another PJ started treating his wounded hand. The same scene was then played again as the Jolly located the second survivor and effected another rescue.

Finally, as they prepared to depart for home, both survivors suddenly realized they were very tired but a bunch pleased that they had been snatched out of there.

Back on base, the survival instructor met with the Captain to debrief. His conversation touched on some problems that had been observed—the beacon, disposing of his extra equipment, tracks in the dirt, travel techniques and the use of his signaling devices. The Captain left the briefing much more aware of what it would take to survive that situation and reflecting back, he did enjoy himself.

But what could he have done to prevent all these problems from cropping up? Next month we'll take each of his problems and a few others and discuss the pros and cons of each.

Questions and comments concerning these articles should be addressed to 3636 CCTW/DOO, Fairchild AFB WA 99011 or AUTOVON 352-5470. ★

GOOD SHOW



Major Charles L. Miller, USAF, formerly with Military Airlift Command is now on an exchange posting with the Canadian Armed Forces Air Transport Group here. He was recently awarded a flight safety "Good Show Award" for the incident described below.

Major Miller is shown receiving his award from Colonel John C. Henry, Base Commander, Canadian Forces Base Trenton. The aircraft is a standard Boeing 707 modified for air-to-air refueling from wing tip pods (not installed).

Major Miller was aircraft commander of a CC137 tanker conducting an air-to-air refuelling mission with two CF5 fighters. The mission proceeded uneventfully from home base of the fighters at CFB Bagotville until arrival over Rankin Inlet on the northwestern shore of Hudson's Bay, where the CF5s were to do a photo recce. While deploying the refuelling hoses for a final top-up prior to descent, the starboard boom and hose assembly extended to its maximum with a severe thump. Subsequent attempts to retract the hose were unsuccessful and the assembly remained jammed at approximately 32 ft extension.

The fighters were topped up from the port refuelling pod, carried out their mission and were escorted back to home base using the port pod for en route refuelling. After exhausting all possibilities to retract the boom and hose assembly and verifying the safe handling characteristics of the aircraft at approach speeds, Major Miller and crew flew the tanker to home base and carried out a low approach and overshoot to allow visual examination of the jammed pod by technical personnel.

Maintenance personnel verified that nothing additional could be done to retract the assembly, and emergency vehicles were alerted for the subsequent landing in the event that residual fuel in the hose caught fire. Major Miller landed the aircraft to the right of the runway centreline, allowing the starboard wingtip and refuelling hose to extend over the grass, touching down and stopping so that the hose and refuelling basket did not make contact with any part of the runway. The skillful landing resulted in no damage to the aircraft, refuelling hose assembly, or aerodrome lighting facilities.

Investigation revealed that the hose response strut had failed, causing the drogue assembly to travel unchecked past its limit of travel, damaging and jamming the internal mechanism of the refuelling pod.

Captain W. J. Cross
Canadian Forces Base Trenton
Astra, Ontario ★

THE IFC APPROACH

LOW ALTITUDE WIND SHEAR

In 1975 a Boeing 727 air carrier impacted the ground approximately one-half mile short of Runway 22L at John F. Kennedy (JFK) International Airport. The National Transportation Safety Board determined that, "the probable cause of the accident was the flight's *encounter with wind shears* associated with a very strong thunderstorm located astride the ILS localizer course."

This accident is part of an upward trend in the number of wind shear accidents, both in the departure phase as well as the arrival phase of flight. What is wind shear? It is, very simply, a relatively fast change in wind velocity and/or direction. These changes in velocity and direction may occur in both the horizontal and the vertical planes.

WHAT CAUSES LOW ALTITUDE WIND SHEAR?

The great majority of low altitude wind shear conditions are caused by thunderstorm or frontal activity. Winds associated with thunderstorm activity may be encountered up to 15 miles from the storm and can be very complex. Because of the many variables inherent in thunderstorm-generated wind shears, this article will not attempt to discuss the effects of such wind shear, nor provide guidelines as to what to expect. If such conditions must be encountered, improper anticipation of wind shear effect could add to an already dangerous situation.

The severity of frontal wind shear is dependent on the type of front, temperature change at the surface across the front, and frontal speed. As a general rule, the amount of shear is greater along warm fronts. If the temperature change at the surface is 10 degrees Fahrenheit or more, or the front is moving at 30 knots or more, you should anticipate significant low level wind shear. The best source of information concerning frontal activity is your preflight weather briefing. One other point should be noted. Frontal wind shear will occur *behind a cold front* and *ahead of a warm front.* You should plan your arrival accordingly —be on the ground well *before* cold front passage or well *after* warm front passage.

WIND SHEAR AND AIRCRAFT PERFORMANCE

Before trying to understand what happens to an aircraft as it passes through a wind shear, we should first understand what inertia is and how it comes into play. According to Webster, inertia is "a property of matter by which it will remain at rest, or in uniform motion in the same straight line or direction unless acted upon by some external force." How does this apply to our problem? Applying Webster's definition of inertia, an aircraft flying at a constant *Ground Speed* (GS) will have a tendency to maintain that ground speed until the aircraft is affected by some external force. Note that the inertia of an aircraft is with respect to the earth, not the air mass it is flying through.

Now let's see how a sudden increase of head wind (or decrease of tail wind) affects an aircraft's performance.

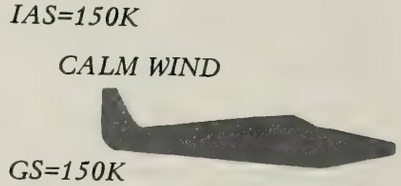


Figure 1a

Flight through calm air mass

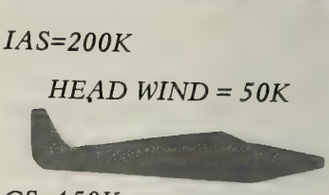


Figure 1b

Instantaneous reaction to sudden HW

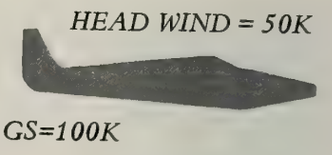


Figure 1c

Indications after a short period of time

Starting with Figure 1a, the aircraft is in stable flight (let's assume Indicated Airspeed (IAS) and True Airspeed (TAS) are the same) in a calm air mass. In Figure 1b, a sudden Head wind (HW) of 50 K is encountered. Because of inertia, the GS tends to remain at 150 K; however, the IAS will show an increase of 50 K (from 150 K to 200 K). If power inputs are not made by the pilot, the aircraft will gradually slow to 150 KIAS again (since the aircraft will seek the airspeed it is trimmed for), resulting in a new GS of 100 K as indicated in Figure 1c. Figure 2 shows the effects of a sudden encounter with a 50 K Tail wind (TW).

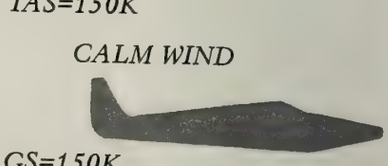


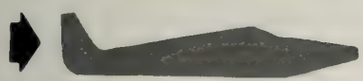
Figure 2a

Flight through calm air mass

to the USAF Instrument Flight Center
Randolph AFB, Texas 78148

IAS=100K

TAIL WIND = 50K



GS=150K

Figure 2b

Instantaneous reaction to sudden TW

IAS=150K

TAIL WIND = 50K



GS=200K

Figure 2c

Indications after a short period of time

Notice the effect that the tail wind has on indicated airspeed in Figure 2b.

In addition to the changes that occur in airspeed and ground speed, wind shear affects aircraft attitude also. In Figure 1b the aircraft experienced an increase of 50 K in IAS. If the pilot did not apply any force to the controls, the aircraft would pitch up (See Figure 3).

How would you expect an aircraft to react if a tail wind were suddenly encountered as in Figure 2b? With the initial loss of IAS the aircraft will pitch down (See Figure 4).

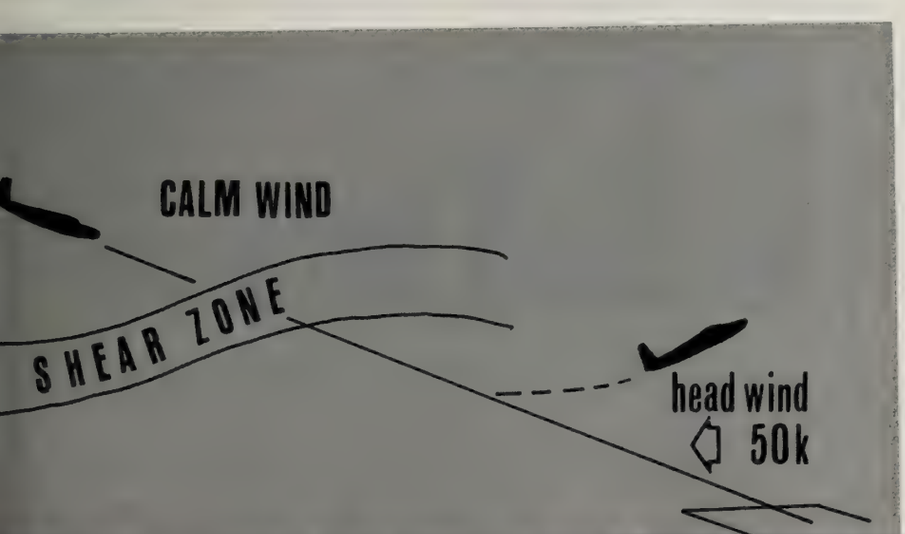
Figure 4



A HYPOTHETICAL SITUATION

Let's assume we've decided to terminate a flight with an ILS approach. The weather is: sky partially obscured, ceiling 2,000 broken, visibility 5 miles with haze and surface winds down the runway at 10 K. Thunderstorm activity exists in the area of the airport. We pass the outer marker and start down the glide slope, on course and on approach speed (140 KIAS). At about 600 feet above touchdown the airspeed jumps to 155 KIAS and the aircraft is going above the glide slope. What would your reaction be?

Most pilots would reduce power in an attempt to slow to 140 KIAS again and apply nose down pressure on the controls to remain on, or get back to, the glide slope. Let's assume we reacted in the same way. We've attained 140 KIAS again, GS is now 115 K, and we are approaching the glide slope from above. At about 400 feet above touchdown we suddenly lose 15 K of indicated airspeed and our vertical velocity increases by 1,000 fpm. Can we recover before we impact short of the runway? Think



about it. Our power is at a reduced setting; our IAS is now 125 K (15 K below approach airspeed); GS is at 115 K; and aircraft attitude is lower than normal. Lotsa luck! !

The conditions encountered in this hypothetical situation are very similar to those encountered by the Boeing 727 at JFK. What, if anything, could be done to avoid such a predicament? We could have bypassed our destination and landed at our alternate. That's one solution, but what if, due to the urgency of our mission or for some other reason, we had to penetrate such conditions.

GROUND SPEED CAN BE A LIFE SAVER

How can GS be of aid to us? First, consider the conditions on the surface. If we calculated an approach speed of 140 KIAS (also TAS for our situation), then the 10 K wind down the runway would give us a GS of 130 K (140 K − 10 K). This time we'll fly the same approach through the same conditions; however, now let's use *two* target airspeeds, a minimum IAS of 140 K AND a minimum GS of 130 K.

We have just passed the outer marker, on course, on glide slope and have established 140 KIAS. Our GS is 130 K (this shows that we have a 10 K head wind at this point). The IAS suddenly jumps to 155 K and the aircraft pitches up. Our GS will stay at 130 K for a short period of time, but gradually the aircraft will seek the IAS that it is trimmed for, if no power or control inputs are made. The overall result will be a gradual decrease of both IAS and GS. How do we react this time? Since our GS is already at the minimum of 130 K, we will have to maintain or add power in order to prevent the loss of GS. In addition, we would adjust our pitch to maintain or recapture the glide slope. Now, our speeds will be 155 KIAS and 130 K GS. At this point, GS is our controlling speed. As we encounter a loss of head wind, the IAS will suddenly change to 140 KIAS and the GS will remain at 130 K. I think you will agree that we're in a much better position to recover this time. Comparing the two approaches, our second approach has us at a higher IAS (by 15 K) and a higher power setting. We've improved our chances of counteracting the downdraft and sudden loss of head wind, and of making a successful missed approach or landing.

Sounds like a super technique, but what about those of us who don't have reliable GS indicators or don't have any source of GS read out at all? The best advice that can be offered is to increase your approach speed (IAS), if you determine that wind shear on final may be encountered (pilot reports are probably your best source of information).

The use of minimum GS and minimum IAS is the best technique known to counteract low altitude wind shear. Research is being conducted in the detection of wind shear using both ground and airborne equipment, but it will be some time before any of these projects bear fruit.

Hopefully, this article has, in a very basic manner, introduced you to the sources of low altitude wind shear and how it affects aircraft performance. There is additional information being published on this topic daily. Read it and understand it. It only takes one encounter with wind shear for it to be your last. ★

PICTURE QUIZ

can you identify these aircraft?

Part of the tradition and history of the Air Force is rooted in the many machines famous and obscure which have served in the past. So for you nostalgia buffs we are starting a feature. Here are four aircraft from the past. How many can you name?

A P-35 ★
B O-47A
C P-37
D B-23



HOLD THE ICE, PLEASE

MAJOR PHILIP M. McATEE
Directorate of Aerospace Safety



At this time of the year we usually have warned of the dangers of aircraft icing. Before we made the same pitch this year, we decided to have the computer here at AFISC identify what have recently been the greatest icing dangers.

We found that while incidents caused by airframe icing have decreased, engine icing is a different story.

The largest icing problem confronting the jet pilot today is engine inlet duct lip, engine dome nose and inlet guide vane icing.

Since January of 1974, there have been 16 incidents where the cause was ice ingestion by an engine. Included on the list was the tragic loss of a CH-53 helicopter with 16 fatalities. In that accident induction ice was dislodged and ingested causing catastrophic compressor failure and a total loss of engine power. Fortunately, the other cases did not involve fatalities but the potential was there.

It is important to recognize that while all USAF jet aircraft have engine anti-ice systems, not all have engine *inlet* anti-ice systems, so you must be very familiar with the system operation on your aircraft.

You should also know the conditions under which ice can form. The conditions most common to engine inlet icing occur when the free air temperature is between $+5^{\circ}C(41^{\circ}F)$ and $-20^{\circ}C(-5^{\circ}F)$ and visible moisture is present or the dew point is within $4^{\circ}C(7^{\circ}F)$ of the free air temperature. Remember when visible moisture is present, engine inlet icing can occur over a wide range of temperatures, above or below freezing. The increase in air velocity as it enters the aircraft engine duct, the engine compressor inlet and the compressor inlet guide vanes causes a drop in temperature of the entering air. Moisture in the air becomes super cooled as it passes through the engine inlet and it can cause engine inlet icing even though external ice is not being formed on the aircraft.

The following incident will illustrate: An FB-111 was cruising clear of all clouds at FL 220. As the aircraft approached its target area, nr 1 engine stalled and rolled back to 60 percent, then completely flamed out. The pilot made a successful airstart and returned to base. After landing, damage from ice was found to the fan case and the first stage compressor. On preflight the auto ice detector had been inop, so the crew was to use manual anti-ice if required. The pilot stated that, since he was clear of clouds at all times, anti-icing was not used.

Should a pilot find himself in an icing environment and have ice build-up on wing leading edges and windshield, etc., before he has initiated anti-ice procedures, he should assume that ice has started to build up in the engine inlet and inlet guide vane area as well.

If you find yourself in this situation it would be a good idea to switch the ignition ON before

HOLD THE ICE, PLEASE

continued





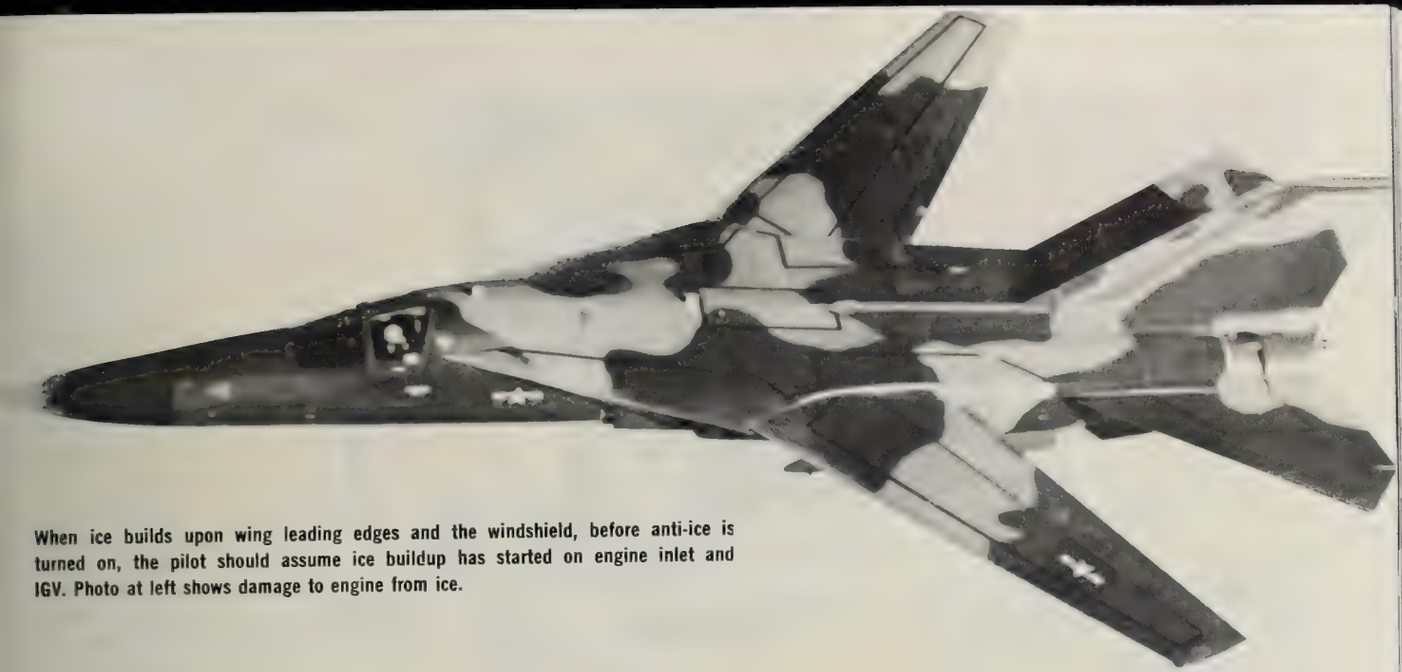
actuating the engine anti-ice system. Keep the ignition on until the ice is gone and stable engine operation is resumed.

When anti-icing system activation is delayed until after ice has already formed, there is a chance of ice breaking off in large pieces and being ingested into the engine. The same situation occurs when the auto-detection system is inoperative and manual anti-ice is used after ice has built up.

is ON or OFF.

Engines with compressor damage from ice ingestion are likely to operate stall-free up to about 85 percent rpm. However, this will depend on the amount of damage incurred. A damaged compressor has a greatly reduced stall margin and will stall with very little inlet duct airflow distortion. Rapid throttle movement, abrupt attitude changes, and tight turns should be avoided.

Although engine inlet icing has caused the greatest number of in-



When ice builds upon wing leading edges and the windshield, before anti-ice is turned on, the pilot should assume ice buildup has started on engine inlet and IGV. Photo at left shows damage to engine from ice.

cidents, there are two other icing dangers that I would like to touch upon.

Recently, a commercial airliner on a ferry flight was destroyed when the aircrew failed to recognize pitot icing. The cause was, tragically, failure to turn the pitot heaters on prior to takeoff. As the pitot tubes iced, the airspeed kept increasing as the inlet aperture was decreased. The crew responded by increasing the angle of attack to reduce the increasing airspeed. This was continued until the aircraft stalled.

The Air Force, fortunately, has not recently suffered a crash caused by pitot icing, but we have had three cases that could have if the pilots had not recognized what was happening. The first incident was caused by excessive water in the pitot static system coupled with a pitot heater failure. The pilot had constant airspeed but was rapidly overtaking lead. Airspeed increased, then dropped to zero. A safe approach was made on his leader's wing.

The two other cases are nearly identical. Both aircraft were on high altitude intercept missions in the vicinity of thunderstorms. Each aircraft received a lightning strike and shortly thereafter airspeed indication became erratic. Both pilots recognized pitot static malfunctions and requested escort aircraft to assist them. In both cases the cause was a burned out pitot heater as a result of the lightning strike. If the pilots in all of these had not correctly diagnosed the pitot static problem the ending could have been tragic.

The last type of icing is airframe icing caused by slush on the taxiway or runway. All of you have heard of slush being thrown up from the runway and freezing in the wheel wells. Well, recently, this led to two cases of frozen landing gear or switches which then failed to extend properly. Again, the guardian angel of aviators intervened and the landing gear was coaxed down and locked. To highlight how severe a problem slush can be, here is an accident involving a civilian aircraft.

The aircraft was on a scheduled flight. The weather was close to minimums with fog and falling snow, and the temperature was right at freezing. The pilot had the aircraft completely deiced prior to taxi. On takeoff roll the pilot noticed about ½-inch of slush on the runway; but all instrument readings and acceleration were normal. Aircraft rotation and liftoff were normal but the aircraft was unable to climb. Despite full power, the aircraft mushed into the ground and was severely damaged. That is what slush thrown up by the gear and adhering to the aircraft can do.

The message in all of these icing tales is to recognize the dangers in time to take protective measures. According to the record, you are more aware of the dangers than ever before. With your continued awareness and prompt action, I hope it is even more difficult to find an icing subject next year.

(Portions of this article have been adapted from previous articles on the subject. Our thanks in particular to Northrop Talon Service News and Lt Col Charles R. Barr, Directorate of Aerospace Safety.) ★



FLY SMART!

CAPTAIN DONALD K. FENNO, Directorate of Aerospace Safety

Did you know that military aviation suffered its first flying loss back in 1908 when Army Lieutenant Thomas E. Selfridge lost his life in an aircraft accident which Orville Wright managed to survive?

Did you also know that the first published aircraft accident rate (fiscal 1921, USAF Accident Bulletin) was 467 accidents per 100,000 hours of flying? In today's terms, that equates to 1,565 accidents per year. Whew! Can't imagine what they were thinking in those days to accept such losses as normal. Agree with me so far? If you do, I "Gotcha," because those accidents were no different from those we are experiencing today. We were losing crews and aircraft to such things as operator error, materiel failure, or maintenance. Those terms sound familiar? They should! Those are the same terms used to describe today's accidents.

Why are today's rates so much lower than yesteryear's? Well, today we devote a lot of time, effort, and money into making flying safe. IFR, radar, and systemized safety are but a few of the things that contribute to safer flight; and over the last 10-year period, innovations such as these have reduced our major accident rate from 5.9 in 1965 to 3.5 in 1975, fatal accidents from 113 in 1965 to 33 in 1975, and aircraft destroyed from 262 in 1965 to 79 in 1975.

We can stop patting ourselves on the back, however, because we still paid about the same amount ($367 million in 1965 and $325 million in 1975) and the fatalities and aircraft losses are still unacceptable. Today's accidents can be categorized within the same areas as the early ones: human error, mechanical failure, and environment caused. My concern is that human error has contributed nearly 56 percent to our accident rate over the past 10 years and will continue to do so until something is done. It is a fact that the proportion of human contribution has not significantly varied since the Air Force started counting accidents. The principal person that can do something is you, the pilot, the navigator, or crew member.

One of the biggest contributors to human factor accident rates is operator error. This category appears everywhere the aircraft flies. For example, during 1975 the following accidents occurred and have been attributed to human error:

Pilot Induced Takeoff Accident	*3*
Pilot Induced Landing Accident	*10*
Midair Collision	*4*
Collision with Ground Non-Range	*7*
Control Loss	*13*

Remember, the crew is the common denominator in all of these accidents.

To digress a moment, I want to dispel a common rumor; the accident board does not attempt to "hang" the crew. In fact, in most

cases they bend over backwards to avoid doing so.

One specific area in which you, the pilot, have control is the area of "pressing." (Pressing manifested itself in many of the operator error accidents in the early 1900s and still does.) How many times have you or someone you know gone beyond the "normal" point of recovery for a maneuver to get the "better score" (collision with ground, range), continued any unsafe maneuver because of peer pressure (pilot induced landing accidents), or just happened to fly out of the flight envelope (loss of control). In these instances, was it really worth it?

Many "good" pilots and crews have been ejected from the game of life because of crew error. In aircraft where the crew concept is needed, the navigator, engineer or copilot are just as responsible for monitoring and *think*ing safety as the AC. Ponder for a moment; what are your chances of survival if you allow the AC to exceed parameters and buy his headstone (collision with ground, non-range)? What I'm trying to say is we (the Air Force) can only institutionalize and instrument the safety game of flying to a point, then the ball is thrown to you, the operator! Ultimately, it is you who makes the decision.

We are improving in terms of fewer accidents. But we have more than enough attributed to materiel failure and the environment, so we don't need the "mistake" of a crew to add to our total. This is one area where you, the crew, have direct control. So let your actions in all situations reflect your internalized decision to fly smart (safely). I leave you with one last thought. Everyone in the Air Force is "the best crew member"; however, can you honestly say to yourself, "I am the safest crew member in the Air Force?" Safety and "The Best" go together! ★

Mail Call

This is your magazine. Please send us your comments and critiques, thoughts and ideas to help us respond to your needs. Send to

Editor
AEROSPACE SAFETY Magazine
AFISC/SEDA
Norton AFB, CA 92409

As the Steward Standardization NCO, 99th Military Airlift Squadron, Andrews AFB, Washington, DC, VC-9C—VC-140B type aircraft, I enjoyed your article in the July *Aerospace Safety* magazine entitled "Escape."

Another reason for writing is to find your source of information regarding the 100 yard distance you quoted after crashing before you stop to look around. We have been unable to find a source other than CDC605XOA, Air Passenger Specialist—In flight, which states 50 feet (minimum). This distance even as a minimum is out of the question. We have been teaching 100 yards as long as I have been here, until the CDC was brought to our attention.

Your response would be appreciated.

ROSS H. PORTER, TSgt, USAF
Stan/Eval Steward
99 MAS, Special Missions (MAC)
Andrews AFB, Washington, DC

Like you, we haven't been able to locate a firm 100-yard requirement. The USAF Crash Survival Investigator's School, the USAF Accident Investigator's School, the USAF Accident Investigator's Course and the USAF Survival School teach 100 yards. Those fortunate enough to walk away from an airplane crash don't want to get killed by a piece of exploding airplane. The photo above of a 120-pound piece of DC-8 wing illustrates our point. One hundred yards may be too far, but it may not be far enough. It's a good, convenient figure most people can estimate.—Ed.



SUBJECT: Do you know the answer?—Article, Aerospace Safety, Aug. 76.

In part, question number eight reads . . . You are in the weather and lose communications just after point A (Figure 2). You climb to 7000 feet *at* point *B* because of the MEA. . . .

It seems to me that in case of lost communications the pilot would need to be *at* 7000 feet (MEA from point B to C) prior to point B. I would like to hear some comments on the subject.

Keep up the good work.

ANTONIO NAZARIO, 1Lt, USAF
39 TAS
POPE AFB, NC

1. In response to your inquiry, the following applies.

a. In accordance with the Federal Aviation Regulations Part 91.119 (b), "Climb to a higher minimum IFR altitude shall begin immediate-

MAIL CALL continued

ly after passing the point beyond which that minimum altitude applies, except that, when ground obstructions intervene, the point beyond which the higher minimum altitude applies shall be crossed at or above the applicable MCA (Minimum Crossing Altitude)."

b. FLIP General Planning defines Minimum Crossing Altitude (MCA) as "the lowest altitude at certain fixes at which an aircraft must cross when preceding in the direction of a higher minimum enroute IFR altitude (MEA)."

c. MCA's are depicted on IFR enroute charts.

2. The answer given in question #8 of the August 1976 "IFC Approach" article reflects the guidance quoted above. If you have any further questions regarding instrument flying, feel free to contact us at AUTOVON 487-4276/4884.
RICHARD L. BUESINGER,
Lt Col, USAF
Chief, Flight Standards Division
USAF Instrument Flight Center
Randolph AFB TX

1. Reference: July 76 OPS TOPICS. "GOTCHA"—this note on Air Traffic Control Radars is a good one but it only touches part of the problem. That 141 crew may well have been working with Tactical or Air Defense radars which do paint weather quite well when the switches are set to do so. The addition of circular polarization to the radar set makes it possible to see through rain clouds which would otherwise mask the aircraft the controller wants to see. However, it also hides turbulent areas.
2. Since it is desirable for the Tactical Weapons Controller (17XX) to know where the weather is for offensive and defensive tactics, he wants it on his scope and has switches to add it on or remove it as needed. The Air Traffic Controller (16XX) is more concerned with the proximity of various aircraft and lining them up with the runway, etc. Therefore, he wants to remove the weather so he can see all the aircraft all the time. The aircrews should remember, when requesting radar services, to know whom you are talking to and what the capabilities are. A systems approach to modern flying is a good one. Ground radars are an extension of the aircraft instrumentation and should be well understood by the aircrews using them. They are part of the system. Just ask any pilot that has done his career broadening in the 17XX or 16XX career fields.

JAMES E. BRIDGES, Major, USAF
Commander
82d Tactical Control Flight (TAC)
Holloman AFB, NM ★

My Brother's Keeper

CAPTAIN JOHN E. RICHARDSON, Directorate of Aerospace Safety

An inexperienced pilot attempts to fly an ACM maneuver for which he is unqualified. The instructor allows him to continue to an out-of-control condition and the crew is forced to eject.

A student pilot is known to be having trouble handling the T-38 in the traffic pattern. He consistently lets the aircraft get slow prior to final turn. One day returning from a formation mission solo, he stalls the aircraft in the final turn and crashes.

A flight of A-7's completes air refueling then proceeds to a practice area. The flight lead does not call for any fuel checks and so the fuel feed malfunction in one of the A-7's goes unnoticed until too late.

A transport makes several approaches to an airport that is below minimums. The aircraft flies in heavy icing conditions for several minutes. On the go-around the aircraft stalls and crashes.

A pilot is known to have several personal problems. For several weeks he has been depressed and preoccupied. He confides to friends that he has not been sleeping well. On an overwater range mission, he does not pull out in time. The aircraft sinks immediately and is not recovered.

All pilots have a self-image which includes independence, competence and skill. We do not like to admit that we are fallible. The old feeling that, if you are really a pilot, you've got to think you're the greatest, can be an insidious trap. If you can't admit mistakes, you usually can't correct them.

This reluctance to admit our own failings also makes us unwilling to recognize weakness in others. To identify any pilot as less than perfect is to cast doubt on ourselves. So we tend to gloss over errors and mistakes. We are not willing to take a stand and say "No. This pilot is not able to perform."

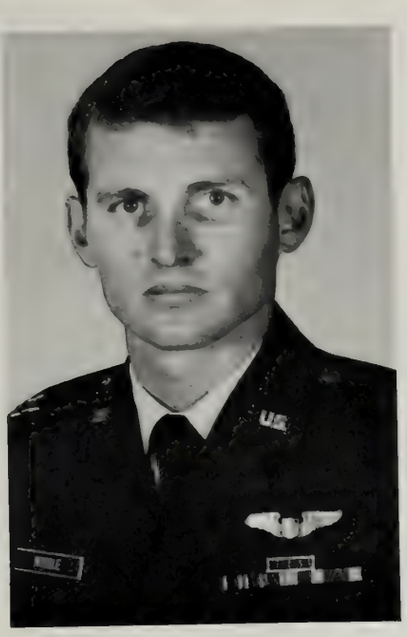
We can no longer hide from our responsibility. Aircraft and trained crew members are too valuable today for us to adhere to the qualification by attrition philosophy. Each of us must work to help one another to the best of our ability. The "hack it or die" approach is as outdated as the Sopwith Camel. We *are* our brother pilot's keeper. ★

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ED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



CAPTAIN



FIRST LIEUTENANT

Jeffrey L. Moddle Warren B. Shaw

401st Tactical Fighter Wing

On 26 January 1976, Captain Moddle, instructor pilot, and Lieutenant Shaw, pilot, were on a local transition ride in an F-4C. Captain Moddle had just completed demonstration of a minimum time turn. As the nose of the aircraft approached the horizon, he retarded the throttles and was about to ask Lieutenant Shaw to take control of the aircraft to practice the maneuver. Before relinquishing control, Captain Moddle noted the nose of the aircraft continuing to rise and attempted to lower the nose with forward stick pressure. He discovered the stick frozen near the extreme aft position. He asked Lieutenant Shaw if he was holding the stick and received a negative reply. As the aircraft nose continued to rise to 60° of pitch, he directed Lieutenant Shaw to select afterburner and began a rudder roll to the left. Upon experiencing the uncommanded nose rise, Captain Moddle had immediately activated the rear cockpit paddle switch to disconnect auto pilot and stab augmentation systems. With no results from his switch, he directed Lieutenant Shaw to hit his paddle switch, check front trim circuit breakers, and see if his checklist was lodged in front of the stick. As he controlled the aircraft pitch attitude with afterburner and rudder, Captain Moddle directed to prepare for ejection and selected guard channel for a "Mayday" call. Both pilots were attempting to move the stick forward with muscle power and full nose-down trim. After 540° of turn with airspeed 120-150 KCAS and angle-of-attack fluctuating from 18-24 units, Captain Moddle asked for one last maximum joint effort to break the stick loose before ejecting. On this attempt the stick broke loose enough to recover to level flight. During their immediate return to base, they completed an approach configuration controllability check. A successful straight-in, approach-end barrier engagement was made with reduced stick available. After the aircraft landed, maintenance personnel discovered an AIM-7 cable dust cover lodged in the stick bell crank. The teamwork and airmanship exhibited by Captain Moddle and Lieutenant Shaw resulted in the safe recovery of a valuable aircraft. WELL DONE! ★

IT'S COLD OUT THERE...



ARE YOU PROPERLY CLOTHED?



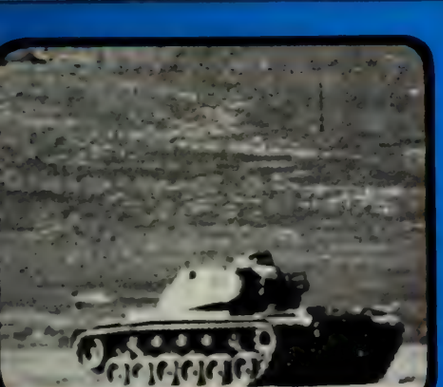
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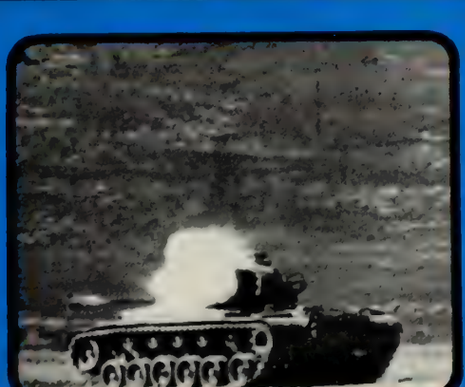
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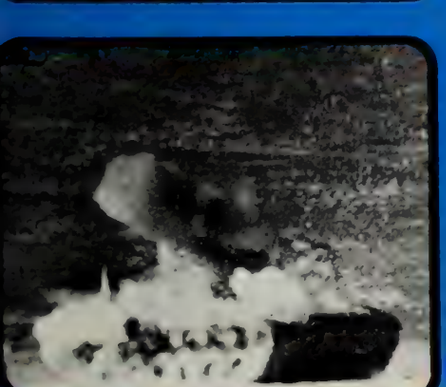
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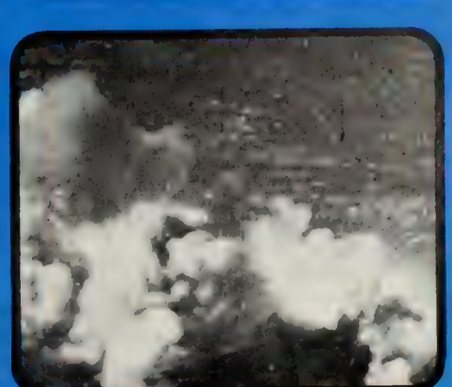














UNITED STATES AIR FORCE

aerospace SAFETY

JANUARY 1977

THE MISSION - - - - - - SAFELY!

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JANUARY 1977 AFPR 127-2 VOLUME 33 NUMBER 1

IT WAS A DARK, DARK NIGHT

CAPTAIN JOHN E. RICHARDSON
Directorate of Aerospace Safety



Lieutenant Dan Smith walked slowly across the ramp toward his T-38. The setting of the sun had relieved some of the heat of the Arizona afternoon and it would be a clear, cool night.

This would be Dan's fourth night ride in the T-38. He was confident of his abilities as he checked the aircraft forms and did the walk-around. He quickly strapped in and soon the characteristic whine of a J85 engine echoed across the darkening ramp. As Dan looked out he could see the lights of his classmates' aircraft as they completed their before-taxi checks.

Soon a line of lights marked the procession of T-38's toward the active. "Cushy 343 night solo ready for takeoff." Dan requests and receives his clearance and then lines up on the runway.

The rumble of the engines becomes a roar as the throttles are advanced. Then the slight pause and the afterburner lights, twin jets of bright blue flame, leap from the rear of the aircraft as it accelerates down the runway and lifts gracefully into the desert night.

Gear and flaps up, afterburner out, and climb established on the departure. Dan Smith is quite busy for a few minutes doing all the things necessary to get a jet aircraft off the ground and up to cruise altitude.

Soon, though, he reaches his altitude of 29,000 feet and begins the first leg of the round robin flight. It is a beautiful night. The lights of Phoenix stretch out toward the horizon. The dark mass of the Superstition Mountains looms in the distance—more felt than seen. The sky is perfectly clear with the stars brightly shining. There is no moon tonight to dim them.

As Lieutenant Smith sails smoothly through the night he thinks of the descriptions he has read of the beauty and grandeur of night flying. All too soon the T-38 is approaching the IAF and the time for daydreams is over. Now comes the descent check and preparation for landing.

The descent track was carefully planned for safety and noise abatement. It came in over the desert well clear of the populated areas to the North and West. Lieutenant Smith was very busy now with checklists and descent procedures and since it was rather dark, he turned up the cockpit lights to see the checklist.

The T-38 smoothly descends to low altitude and starts the arc toward the final approach. Lieutenant Smith is busy with approach checks and other cockpit duties when a light blinks on the caution and warning panel.

Dan concentrates on the panel trying to determine just which light had blinked. He is not paying attention to his altitude and doesn't notice the descent. Then something outside the cockpit catches his eye and he looks up. It's hard to see because of the bright reflection of the cockpit lights, but Dan suddenly realizes that what he saw was a *tree*. He yanks back frantically on the stick and shoves the throttle forward. But then there is a thump and a grinding, tearing sound and a spinning, tumbling sensation as the right wing smashes through some trees and hurls the T-38 to the ground.

A few minutes later a classmate of Dan's making the same letdown reports a bright fire on the ground. It takes the crash crew almost 2 hours to get to the wreckage because of the rough terrain, but by sunrise they have all the pieces identified from Dan Smith's last flight.

This flight is fictitious. Yet it contains elements of several real accidents. Although Lieutenant Smith is a student pilot, many of the accidents involved highly qualified, experienced crews. This is the kind of accident that can only be prevented by the pilot. We all can be distracted or become complacent. It's a trap which we must work to avoid because one lax moment at the wrong time is all it takes. ★

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Is It Worth It?



MAJOR THOMAS R. ALLOCCA
Directorate of Aerospace Safety

Decisions, decisions. You own a 1966 Ford with 120,000 miles on it and you're about to make a coast-to-coast trip. Should you have the engine overhauled?

You're enrolled in an off-duty graduate program and there's an end-of-course quiz coming up . . . should you study for it?

Decision making. Of the infinite variety of human behavioral patterns, none is more pervasive than decision making. We all do it—all the time. The examples cited above are the kinds of decisions we make daily and may rightly be considered trivial. But not all decisions are so. Many involve vast sums of money or even life and death. For example, "should the Air Force spend millions of dollars to outfit its entire fleet of aircraft with a ground proximity warning system?" or "should the attitude-indicating system of a wide-bodied transport be modified to provide increased system reliability?"

The readership of this magazine will surely contain many managers and soon-to-be managers who may, some day, be called upon to pass judgment on such questions. And when they are, how should they react? Let's begin by briefly discussing decisions in general.

A decision must never be called a "good one" or a "bad one" solely on the basis of how things work out. The decision to repair the Ford's engine may appear foolhardy if the car is totally wrecked a week after the repair investment is made. But this is Monday-morning quarterbacking at its worst. Conversely, if we make a highly speculative decision which, by all odds, has little chance of working, we should not credit ourselves with "good" judgment if things turn out well.

The ambiguity here involves a distinction between two decidedly different things: the merit of the alternative chosen (viewed as either "good" or "bad" by the Monday-morning quarterback) and the merit of the *method* used to select the alternative. While we (particularly those of us in the safety business) can never be sure that a particular decision will turn out right, we owe it to ourselves and the Air Force to be sure that the *method* used to make the decision was the best available. With this thought in mind, let's return to the wide-bodied transport's attitude-indicating system reliability problem.

Should we spend X number of dollars to improve the reliability of the attitude-indicating system? To answer this question, with the above discussion in mind, we must consider the concept of the "expected cost of an accident."

Obviously the issue of whether or not to modify the system was raised as a safety concern. If the existing



system completely fails at a time (night/IMC flight periods) when pilot recovery attempts will be unsuccessful, . . . well, we've lost one very expensive wide-bodied transport. But, and in this austere era this is a crucial but, what happens if we spend X number of dollars (which could have been spent elsewhere) to prevent an accident which may never happen? Either we spend the modification monies or we don't —a tough decision. But let's remember the "soundness of the method" discussion.

If we make the modification we're betting that we'll save (in dollars not lost in accidents) more than we spend. That one sentence contains the entire rationale of the "expected cost of accidents" enthusiasts. To properly understand this rationale, a brief discussion of "expected values" is appropriate. And to best understand a concept built upon the laws of chance, a "game of chance" example is both illustrative and appropriate.

A "good" buddy offers you this deal: you pay $1 to roll two dice. If you roll two sixes, you get your $1 back plus two dollars. If you roll a six and a "not-six," you get back your dollar plus one dollar. If you roll two no-sixes, you lose your dollar. Before you decide, you clearly have two alternatives—to play or not to play. But which of these alternatives is the "best bet?"

Decisions such as these require some knowledge of the laws of probability. In this game there are two acts—play or don't play—and three events: 2 sixes (you win $2); 1 six (you win $1) or zero sixes (you lose $1). What are the chances of: rolling 2 sixes in the roll of 2 dice? Rolling 1 six in the roll of 2 dice? Or, rolling zero sixes in the roll of 2 dice? They are 1/36, 10/36, and 25/36 respectively. Now a realistic decision must consider both the odds and the payoffs. The most satisfactory method of combining odds and payoffs is simply to weight each payoff by the odds that it will occur, add the weighted payoffs for each act, and choose the act that has the highest weighted average. This is done below.

		ACTS			
		PLAY		DON'T PLAY	
EVENTS	ODDS	PAYOFF	WEIGHTED PAYOFF	PAYOFF	WEIGHTED PAYOFF
2 SIXES	1/36	+$2	+ 2/36	0	0
1 SIX	10/36	+ 1	+10/36	0	0
0 SIXES	25/36	− 1	−25/36	0	0
		WEIGHTED AVERAGE −13/36			0

IS IT WORTH IT? continued

In this game the weighted average (also known as "expected value") is $-13/36$, or approximately -36 cents for playing and 0 cents for not playing. So, *in the long run,* you will lose 36 cents for every dollar played and you'd best tell your "good" buddy you'd rather not play. Now let's apply this same kind of reasoning to the modification decision.

The question—and we'll use numbers for illustrative purposes only—is this, "should we spend $500,000 to improve the reliability of the attitude-indicating system of a wide-bodied transport?" The acts are obvious: modify or don't modify. But the calculation of the events warrants a brief discussion.

We're obviously thinking about this modification because of the safety implications: we don't want to lose a wide-bodied transport because of a complete failure of the attitude-indicating systems. What is the likelihood that this will occur? To answer that question we must first address this question:

"What is the probability of losing a wide-bodied transport due to a complete failure of the attitude-indicating systems during a flight phase from which pilot recovery attempts would be unsuccessful?" And this question involves these three independent probabilities:

a. Probability of a complete system failure (assumed to be 2.0×10^{-5} per flight hour, or twice in every 100,000 flight hours);

b. Probability that the failure will occur during night/IMC flight periods (assumed to be .50; that is, that 50% of all penetrations and landings are made during night or IMC conditions);

c. Probability that if a and b occur the pilot will *not* be able to effect a safe recovery (assumed to be .50).

Now the likelihood that a, b and c will occur simultaneously is given as a times b times c or $(2.0 \times 10^{-5}) \times (.5) \times (.5) = .5 \times 10^{-5}$ or this event (loss of a wide-bodied transport) is likely to occur once each 200,000 flight hours.

For illustrative purposes, let's assume we have a fleet of 100 wide-bodied transports and it is predicted that each will fly an additional 10,000 hours before retirement from the active fleet. Therefore, the fleet will fly 100 X 10,000 or 1,000,000 more fleet-hours. Since the "expected loss rate" is one each 200,000 hours, we can expect to lose 5 wide-bodied transports to attitude-indicating system failures over the life of the fleet. If we assume the cost of each transport is $5 millions, then our "expected cost of accidents" is computed as $25 millions. Therefore, it would appear that the $500,000 investment would be well spent. Why do I qualify the statement? Because we must know what degree of improvement (in terms or decreased likelihood of accidents) we can expect from the modification.

Let's assume the proposed modification (to build redundancy into the existing system) will result in a likelihood of system failure of $.25 \times 10^{-5}$ per flight hour, or a complete system failure once each 400,000 flight hours. This in turn must be multiplied by b and c above (which have not changed) to yield the "modified" likelihood of the accident: $(.25 \times 10^{-5}) \times (.5) \times (.5) = .0625 \times 10^{-5}$ flight hours or the accident is likely to occur approximately once each 1,600,000 flight hours. Since the entire fleet will fly an additional 1,000,000 hours the likelihood of the kind of accident we've been discussing becomes $\frac{1{,}000{,}000}{1{,}600{,}000}$ or .625. Since the wide-bodied transport in question costs $5,000,000 the "expected cost of accidents" is computed as $.625 \times \$5{,}000{,}000$ or $3,125,000 with the modified system. Now the modification argument can be expressed thusly:

a. If we don't modify, the expected cost of accidents is $25,000,000.

b. If we do modify, the expected cost of accidents is $3,125,000.

The modification decision is perhaps made a bit easier when viewed in this light and from this perspective: *in the long run* we can expect to save (in dollars lost in accidents) more than we'll spend on the modification.

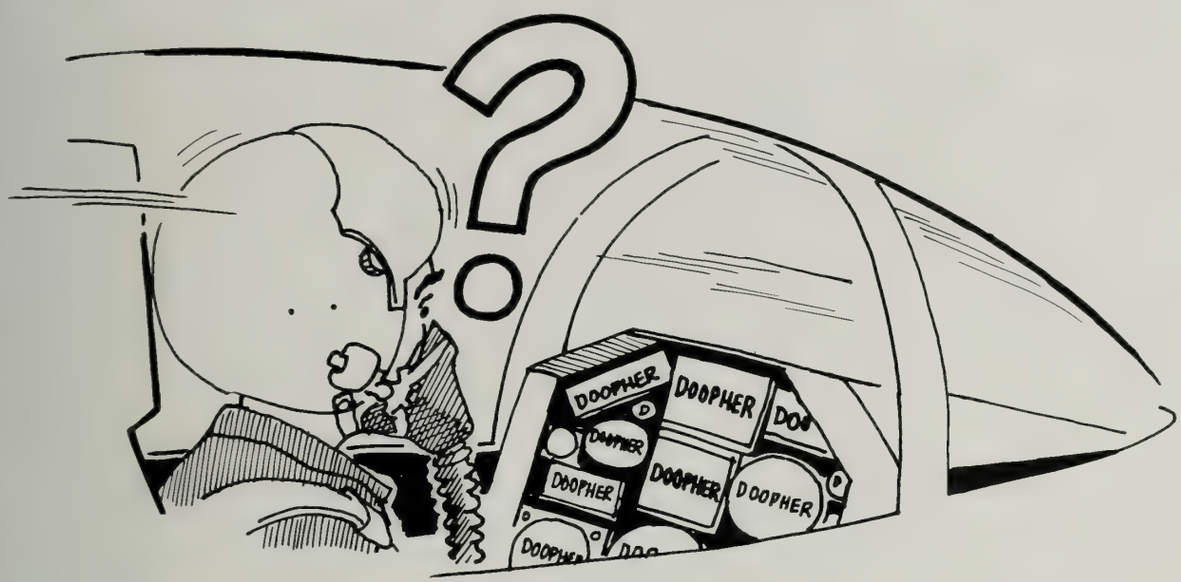
"Should the Air Force develop a less flammable hydraulic fluid for use fleet-wide?" "Should all single-place fighter aircraft be outfitted with high intensity strobe lights?" These are tough questions made even tougher because every dollar spent thusly cannot be spent somewhere else. But regardless of the awesome complexities of such questions, they must be answered.

This short discussion has highlighted one analytical technique available to the decision-maker. Such techniques are not substitutes for judgment; rather they are aids to the person who must select from a group of alternatives. Questions such as those addressed in this article must be approached in a logical, rational manner . . . to this end the "expected cost of accidents" may be helpful in deciding if "it's worth it."

The author wishes to acknowledge that ideas presented in this article were extracted from portions of the text, Business Decision Theory, *by Jedaemus and Frame.* ★

DOOPHER* THE INSTRUCTOR

OR...how to give a hazardous briefing



LT COL HELMUT OBERBRINKMANN, GAF • Directorate of Aerospace Safety

. . . Again 6 o'clock briefing for me (how come I'm always the poor F-104 student in the first briefing slot of the day?). Being already late I find myself filling out the data card with all the necessary information on a Ground Attack 1 Mission. Rushing through my typical fighter breakfast of one cup of coffee and one doughnut, I manage to reach the briefing room a split-second before instructor fighter pilot John Zipper walks in 10 minutes late.

Smoking his early cigar, John Zipper glances into the doopher guide and starts hammering his highlights of flight into our heads. He stresses taxi spacing (I'm just listening to the seventh technique to maintain 150 ft) while I'm wondering when he wants me to accomplish my before takeoff checks. Reaching the meat of the mission, Zipper tries to give an impression of the individual switch settings for each event. He turns this doopher, he switches that doopher, opens the bomb doophers, re-checks the doopher in the manual position, makes sure that the rocket doopher is in the doophing position, selects the doopher in the stand-by position, pushes the doopher for a green light and squeezes the trigger to hit the doopher in the bomb circle . . . STOP!

*** Translation:**
Doopher (Dooper)
Usually a word that is used when you cannot think of the correct wording or nomenclature.

Start to think, IP. You are on the range and your foreign student cannot release his weapon. You are responsible to re-ensure the correct switch settings for that particular event. But how can you ever achieve with your doopher method, and especially airborne, the help you need to give—screaming doopher positions? Or how do you explain to your student how to emergency-jettison his napalm bombs?

But it may even get worse for you, John Zipper. Flying on downwind, your student sees an engine oil low-level light. He pulls the nozzle handle with no reaction on the nozzle. Now there you sit, famous briefer, trying to doopher the aircraft in distress to the nearest doopher. Halfway, your student may not understand your fast spit-out doopher information anymore and calls you on the radio: . . . I'm leaving the airplane with my doopher! ★

TECHNOLOGY IS ONL



MAJOR JACK SREY

History cannot tell us when polynesian seafarers first sailed beyond the sight of land. A bold venture it must have been with only the sun to provide directional guidance. Over the years these daring skippers learned that stars could provide bearing information. Time also taught them that wave patterns could at times be relied upon for steering. Observation of certain birds, departing their feeding grounds at sea, soon became accepted as a reliable directional indicator, pointing toward an island. With a "seat of the pants" feel, these early mariners soon were able to detect a reflected wave superimposed in the primary wave train, thus providing evidence of an unseen land mass beyond the horizon.

These bold men soon were capable of making an accurate landfall after days or sometimes weeks without having seen the sight of intervening land and without use of man-made instruments. Orientation was maintained by visual observation of their environment—their sea and sky; the most subtle signs were noted, processed, and stored in their brains. This highly developed skill, requiring total dedication and a highly developed sense of observation, permitted them to navigate successfully uninstrumented and with the same accuracy obtainable after the invention of the compass, timepiece, and sextant.

Until the invention of the compass, the mariner's first instrument, the Captain had no technology on which to rely. His success or failure as master of his ship rested completely on his skills. Decisions were based on what he had learned, sometimes painfully, over the years by observation of the sea and his vessel. Even while off watch, the motion and sound provided clues to changes in the wind, sea, and conditions of rigging. It is easy for all of us to picture a ship's master standing squarely on a rolling deck. His face ruddy and lined, with eyes intently studying the sea and sky, as spray bathes his face.

In 1903 at Kitty Hawk, man achieved a life-long dream. Two humble men succeeded in joining the eagles. The conquest of air and space had begun. For the next 20 years early aviators had little technology to help them. As with the mariners of an earlier time, the first aviator had to rely solely on his own

N AID



knowledge, the fundamentals of flying, and observation and perception of the sky. His abilities permitted him to pioneer transcontinental air travel. In combat over Germany he dominated the sky, all without Gyro or radio. The achievements of the early aviators must be regarded as remarkable since they were performed with little aid from technology.

In 1920, we saw the first electronic navigation aid—a simple radio beacon; and in 1929, Jimmy Doolittle demonstrated all-weather capability by flying an aircraft solely on instrument reference during IFR conditions. In the early thirties, we also saw the introduction of a lightweight radio, reliable enough to be a worthwhile aid for a pilot. The technological advances in aviation have vastly improved the reliability and safety of flight, and permit us to do our tasks faster and in poorer weather conditions.

When was the last time you had to "cage" an engine on a C-141 in flight? When was the last time you had to abort a takeoff for low power? Fifteen years ago, flying "Old Shakey," this was often the rule rather than the exception. Today, critical emergency situations still occur, but less frequently. If we are not careful, we can be lulled into complacency by this reliability and be caught napping during the few seconds in which the situation can escalate beyond our control.

Low power on takeoff, requiring an abort, still happens. Critical emergencies such as engine failure or fire at lift-off still occur. Engine fire during cruise, requiring immediate action, is rare but can escalate out of control if not dealt with promptly and correctly.

Technological advances in aviation have vastly improved reliability and enhanced safety of flight, but critical emergencies—those that can kill us if not handled promptly and correctly—are still with us. Fundamental action is required to solve these problems and it varies little from aircraft to aircraft. In the past, today, and in the future, sound knowledge of the fundamentals continues to be essential. The pilot who fails to master the fundamentals and to know and understand his aircraft has a questionable future. To borrow an adage from the mariner: "Be prepared for the worst, the best takes care of itself." ★

OUT OF THE PAST



CAPTAIN JOHN E. RICHARDSON • Directorate of Aerospace Safety

There are few new mishap causes. Each year the accident files contain the same types of mishaps, so perhaps we should follow the advice of Santayana and study the mishaps of the past. This page contains accident briefs and Ops Topics from the *Aerospace Safety* magazine files.

The pilot of the F-86H entered a normal landing pattern, dropped the gear and flaps and made the "gear down and checked" call. However, the pilot did not really check the gear and, although the doors opened, the gear did not extend. Fortunately, the mobile control officer spotted the malfunction and sent the aircraft around. A rather embarrassed pilot recycled his gear and made an uneventful landing.

* * *

A student pilot completed his night solo mission with a reasonably good landing. However, halfway down the runway he discovered that the T-33's right brake was inoperative. As a result, his ride terminated with a barrier engagement. (One of the required checks in the T-33 checklist was a brake check prior to landing. This was not done.)

* * *

After completing a normal duty day at their administrative jobs, a pilot and copilot were scheduled for a 2000 departure in a C-45 to make some parts pick ups. A maintenance delay prevented the takeoff until 0035. The aircraft made its first destination with one intermediate stop and departed after 5 hours ground time. The next RON stop was at 1835. The crew took off the next morning at 0645 and, after two more enroute stops, started the final leg home at 1555. Forty-five minutes later the pilot declared an emergency because the aircraft had lost a propeller. He stated that he was going to land at a field 10 minutes away. Shortly after, the pilot transmitted that he had the field in sight and was preparing to land. While on approach, the aircraft stalled and crashed, killing the pilot. Although the loss of the propeller is the prime factor in this accident, the fact that the pilots had only 4

hours sleep in the previous 60 hours is definitely a part of the cause. No one can be fully capable with as little crew rest as that.

* * *

The RB-66 was making a standard jet penetration. The pilot acknowledged completion of the procedure turn at 7000 feet. Approximately 2 minutes later the bomber, flying straight and level, slammed into a hillside at *1620 feet.* There was no evidence of malfunction. The minimum descent altitude on the approach was 3000 feet.

* * *

The jet transport was at FL 350, Mach .82, 278 KIAS. The copilot was busy filling out forms. The panel engineer called the pilot's attention to an indication of generator difficulty. No one noticed that the generator OFF light had come on simultaneously with the onset of the generator problem. In the next 2 minutes over 1000 feet of altitude were lost, Mach increased to .86, heading changed 40 degrees and bank angle reached 30 degrees. During the recovery the g meter registered 2.9 g.

* * *

Shortly after passing S-1 speed the pilots of the KC-135 noticed that the instrument panel was ajar. Immediately after rotation the top of the instrument panel fell toward them. The pilot and IP sitting in the right seat caught the panel after about 4 inches of movement; and the IP flew the aircraft while the pilot refastened the panel. This was the first flight for this aircraft since its return from depot. It seems that depot personnel had neglected to secure the panel. ★

FOOD FOR THOUGHT!

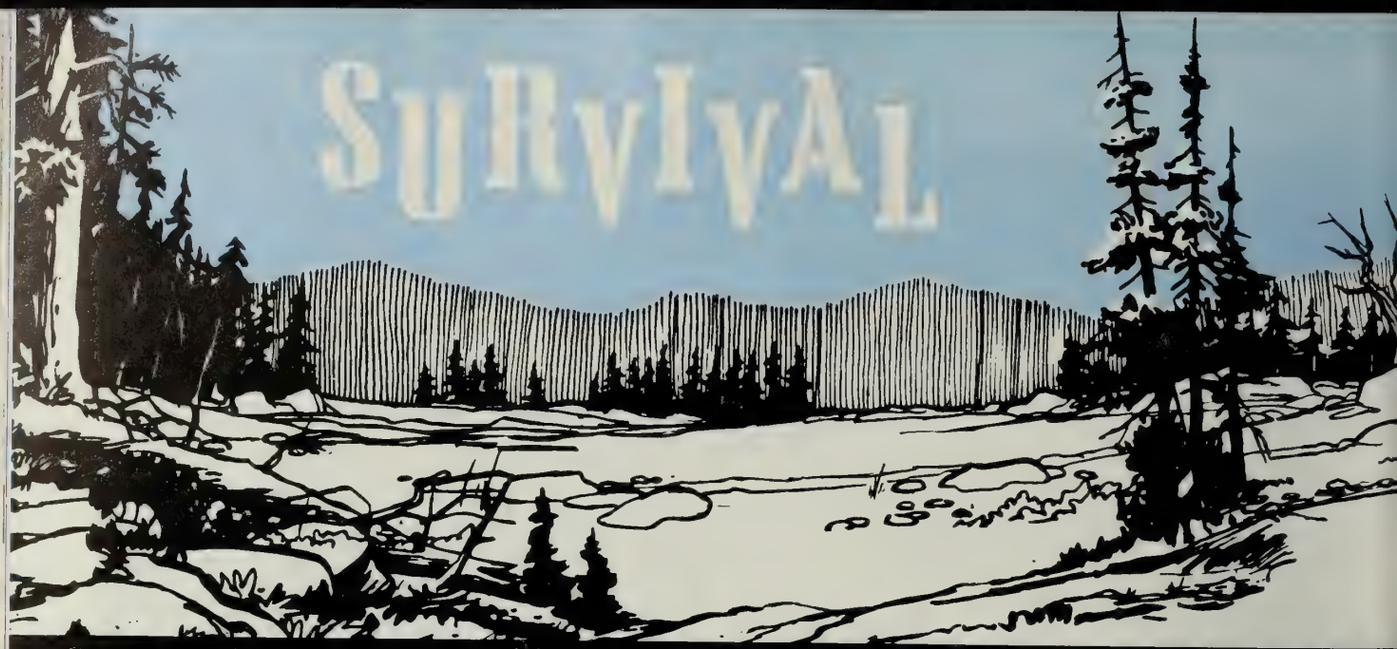


Recently an experienced IP gave a J-85 engine the opportunity to prove that it is tougher than a Low Altitude Enroute Chart. During climb to cruise altitude the IP opened the front cockpit map case to get a low altitude chart. About the time he found it, his excellent cross check picked up a 300 foot overshoot of level off altitude. The IP assumed control and applied the appropriate stick movement, resulting in a momentary negative-g condition.

After landing, the checklists were accomplished and the canopies opened. The IP shut down the engines when he heard an unusual hissing noise from the left engine. Maintenance found a low altitude chart wadded against the inlet guide vanes. The J-85 had shredded the chart, but received no damage. With a complete cleaning and inspection, the engine is flying again.

The instructor and student failed to see the possibility of something having floated about the cockpit during the less than one-g condition. The chart probably floated, unnoticed, to a position on or behind the front seat. When the canopy was opened, the charts followed the law of selective gravitation: "Any item dropped will fall in the worst possible place."

Each pilot should carefully consider the events of each mission and inventory cockpit and personal equipment in detail prior to opening the canopy. The mirrors can be used to check the top of the seat. The back seat occupant can check the top and back of the front seat. If any doubt exists, taxi back in with the canopies down, select ram dump, shut the engines down, and then open the canopies.—14th FTW Flight Safety Bulletin, no 22, 26 October 1976. ★



RED FLAG - Part II

CAPTAIN RONALD E. VIVION
Programs and Current Operations Branch
3636th Combat Crew Training Wing
Fairchild AFB WA



In my last SURVIVAL article, I discussed a scenario at the Red Flag exercises where two crew members were inserted and subsequently rescued as a planned part of that exercise. I also stated that a few mistakes were made and that they would be discussed in detail this month.

Since the writing of that first Red Flag article, we've added a few new twists at Nellis and we're presently reviewing our findings. When we have finalized our conclusions about the results of the new scenarios, we'll report back with another article. But the thrust of this one is to analyze the errors made and discuss how to prevent them.

The first error the Captain made last month was to get shot down. We can't comment on that except that, if you always land in the same aircraft you take off in, the chances are that you will never need survival knowledge—at least not on the job. My point is that preparation for survival definitely includes becoming the very best at your job.

In the prebriefings for the SAR scenario, we have found a number of crews that weren't sure about the URT-33 beacon. This small radio transmitter can be extremely valuable and we definitely recommend you keep it. Make certain it is turned off—as a helpful hint, "What you see is what you get." If "off" is visible, it's not transmitting. Even though you can't receive on this piece of gear, there is a possibility that your survival radio transmitter may be inoperative or your radio may not work at all. The beacon can provide an alternate communication device, so it should be kept with you.

The next area of confusion appears to be what to do with the excess material you will have at the landing site. We still teach that before you throw anything away make certain you will never need it again. This obviously gets into an area of marginal return because every single item you have with you at the landing site can be improvised and used again. But is it worth it?

The prime question remains, "Can I do without the item in favor of re-

ducing bulk and weight?" These decisions need to be made quickly and accurately. You would help yourself greatly if you decided in advance. As an example, over water the life raft will be of prime importance but in the mountains is it vital? In an E&E situation you certainly don't want anything hindering your progress, so choose carefully.

Once the decision is made to scrap some of the items, a serious mistake is often made. In the survivor's concern about giving away the landing site, the decision is often made to carry the excess baggage with him and discard it along the route of travel. Unwittingly, this confirms the route of travel to the searchers. If they are following a trail and find buried material, they are then sure that they are on the right track.

Probably the best technique for disposing of excess equipment is to hide it under a bush, a rock, in a shadow, etc., at the landing site. Burying it should probably be a last resort because of the time required and the difficulty of digging in most terrain without a shovel. To aid in hiding the gear, you might also consider wrapping it up in the green or brown parachute cloth. Since most of the landing areas of the world are those colors, it will be hard to find.

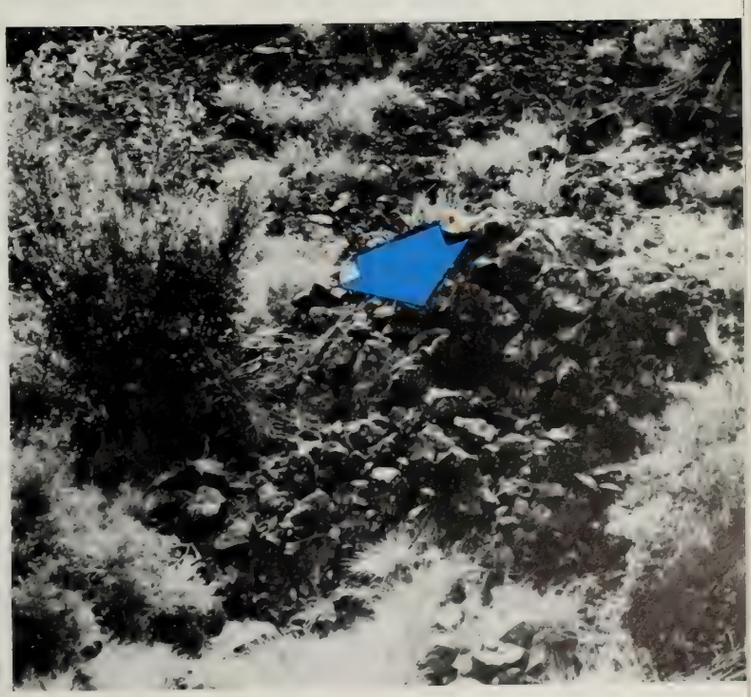
Once the landing site is secure, it is imperative that a great deal of care be given to leaving the landing site. The chances are that the "Last of the Mohicans" won't be tracking you, but if you stomp off without making any attempt to hide your tracks, even the most novice individual will be able to follow. Hiding your tracks isn't that tough, but it does require concentration. Never relax or forget you've got to hide your route. If you do it well, a search party must comb all quadrants for tracks, thus taking time and manpower. You should make their job as tough as you possibly can by picking the hardest route available and not traveling in a straight line. Move slowly, and stop, look, and listen. Sound can travel great distances, especially when you, the enemy, and the tweety birds are the only ones out there making noise. And when you travel, have an objective in mind.

Many individuals who have actually evaded have experienced that sickening feeling when they discovered that they had E&E'd right back to the same spot where they had been previously. The best technique is to pick a spot and travel to it then pick another, etc. The compass you have in your kit can be a very helpful device. Even though it may look small and inaccurate, it can spell the difference.

In choosing your travel route, use all available means to hide yourself. At Fairchild, we still teach the military crest route, or ⅔ to ¾ of the way up a ridgeline. In most environments this is the type of terrain the enemy would least prefer to move in and will usually provide cover. But by all means, don't use it if there is no cover there. In a desert environment it would be much wiser to travel in a dry creek bed or washes —but not in the bottom. Parallel the bed of the creek and travel slightly up the slope. There will often be vegetation in this area and the terrain will help mask your position.

In hostile territory, survivor should leave as few clues to his presence as possible. Footprints are prominent on soft ground in photo, above left. Hide equipment under a bush or in rocks, as at right. See the gear?—in the center of photo.







Each piece of gear takes only one hand, as demonstrated in photos. In each case, survivor is using two items at once—su radio and mirror or smoke.



The problems I mentioned last month with vectoring and signalling still remain. The biggest area of concern is that crews can operate each separate piece of equipment individually, but when they are all put together, it gets busy. Remember that each piece of gear only takes one hand. Theoretically, you can even talk on the radio and flash with the mirror simultaneously. It just takes practice. The mirror, by the way is probably the simplest and most effective means of showing the SAR force where you are. Survivors have often been seen on the first flash in the desert. But make sure that first flash doesn't hit the ground and tell the bad guys where you are—start high!

Your smoke (MK-13) flare is good but if everything isn't just right, its effectiveness is lessened. Remember, in a fast-moving SAR it is vital that the flare is prepared well in advance. If you wait until the Jolly arrives to prepare it, he may be well past your position before the smoke is out. And think about how you'll operate the flare one-handed. For that matter, give that line of thought to all your equipment. You may well have a medical problem that will prevent your using both hands. A good hint for pulling the flare lanyard with an injured hand is to use your foot. Step on the lanyard and pull. Please, please, don't use your teeth!

Communications on the radio can be critical. Things happen fast and the tendency for most survivors is to get in a hurry. Keep calm and keep talking. Don't give away your position on the radio and if there are several of you on the ground, it is mandatory that you establish your pecking order before you get into a survival situation. We've had several situations where multiple crews didn't coordinate their SAR beforehand and the resulting garble on the radio was mind-boggling—so much so that rescue was definitely hampered and probably would have been prevented in an actual combat SAR.

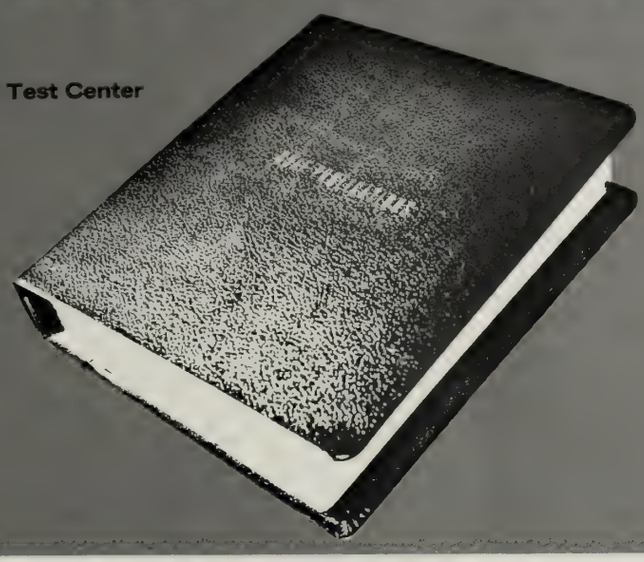
The techniques that I have provided should have been very evident when you read last month's article. The difficulty remains that there are people out there who aren't getting the word. Even though Red Flag is being conducted in a desert environment we haven't found an item yet that doesn't apply to almost any area. The key appears to be to pass the word and think about survival. In SEA, crews spent a good deal of time directly concerned over the equipment they carried because they knew that their turn could be next. The chances today aren't that much slimmer. Granted, nobody out there is playing real-live shoot-em-up, but that potential still exists. The old saw about "preparedness" is definitely in order and Red Flag tries to provide that. But you must do the rest.

If you have any questions or comments concerning the materials in this article, please feel free to call or write to us. Our address is:

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It's not just good sense... IT'S THE LAW!!

MSGT R. A. SMITH
Armament Development and Test Center
Eglin AFB FL



Sound familiar? You've heard it on TV in reference to the 55 mph speed limit, now let's apply that same idea to technical data and maintenance on aircraft away from home station. When you consider the variety and complexity of the aircraft in the Air Force today, it makes sense that our maintenance personnel must use the proper tech data to inspect transient aircraft on the ground. After all, would you operate your sophisticated bird without the flight manual and associated checklists? TO 00-5-1 and other publications direct that the use of tech data is mandatory for all actions, regardless of their apparent simplicity; so it's quite clear that it's not just good sense—it's the law.

Most transient alert sections maintain enough tech data for those types of aircraft which frequently visit the base; however, they cannot be expected to maintain a file for each type of aircraft in the Air Force inventory. We're back to that good sense part again. Guess that's why TO 00-20-1 requires (it's the law) that aircraft scheduled for cross country or TDY missions have the servicing checklists and inspection work cards carried on board.

This doesn't pose a problem for those aircraft which are required to have a "G" file aboard but it requires some action on your part if you're driving one that doesn't. In order to ensure that your bird receives its due attention and to avoid lengthy delays, ask the maintenance troops if those important pubs are aboard prior to your next departure. Don't forget to find out where they're stowed so you can pass them on to the guys in white at your enroute stops, in case they don't have your particular model on file. If you want to really show them you're up tight and out of sight, whip the reference of TO 00-20-1, para 4-12e on them.

With the right tech data, the transient troops should be able to provide you the safe and timely service you deserve. This will most likely result in happy faces for all —the TA troops, maintenance management, the safety experts, quality control and YOU. ★

THE IFC APPROACH

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

A NEW YEAR'S NOTE

With the advent of the new year, every Air Force pilot should personally resolve to make this year accident/incident free. The "IFC Approach" articles are intended to help pilots accomplish this goal. If there is a subject or question you would like to see addressed in an "Aproach" article, please write to the USAF Instrument Flight Center and let us know. One of our primary goals is to provide Air Force pilots with the most current information available concerning instrument flying and we use the "IFC Approach" articles extensively to accomplish this function.

REVISION OF "IFC APPROACH" ARTICLES

Each year the Instrument Flight Center reviews past "IFC Approach" articles for currency. Articles considered current are those published after December 1973. Since many of our readers keep copies of our articles and use them as a review for instrument checks and also as teaching aids for annual instrument school, we publish this revision each January.

A limited number of booklets of reproduced articles is available for distribution to those who wish to start an "IFC Approach" article file. A set of the articles will be mailed to you upon request. If additional copies are needed, they may be reproduced locally. Your request should be addressed to:

USAF Instrument Flight Center/FSD
Randolph AFB, TX 78148

The following changes and deletions to previous "IFC Approach" articles should be made as indicated.

September 1974—Delete entire article.

October 1974—Delete last question and answer.

November 1974—Delete the 1st, 2nd and 4th question and answer under Radio Calls.

April 1975—Delete the third and fourth question and answer. Change the definitions of Minimum Safe/Minimum Sector Altitude to read:

3. Minimum Safe Altitude. Established for all procedures within a 25-mile radius of the navigation facility. Provides at least 1000 feet of obstacle clearance for emergency use.

3a. Minimum Sector Altitude (MSA). MSAs are established for all procedures within a 25-mile radius of the navigation facility. A radius of 30 miles from the airport may be used when the primary facility exceeds 25 miles from the airport. When the procedure does not use an omnidirectional facility, i.e., LOC BC, the primary omnidirectional facility in the area will be used. A common safe altitude may be established for the entire area around the facility or sector altitudes may be established to offer relief from obstacles. Sectors will not be less than 90 degrees in spread. The sector altitude established shall also provide 1000 feet of obstacle clearance in the adjacent sector or periphery area within four miles of the sector division or the periphery boundary line.

July 1975—Delete the 2nd question and answer.

August 1975—2nd Question and answer, change reference to read "FAAH 7110.65, para 773."

4th question and answer, change to read, ". . . highest obstacle within 5 NM. . . ."

5th question and answer, change reference to read "FAAH 7110.65, para 236."

6th question and answer, change reference to read "FAAH 7110.65, para 20, 233, and 236."

7th question and answer, change reference to read "FAAH 7110.65, para 1192."

10th question and answer, change reference to read "FAAH 7110.65, para 604."

December 1975—3rd question and answer—change reference to read "FAAH 7110.65, para 233."

4th question and answer—change reference to read "FAAH 7110.65, para 233."

Clearance #5: Change to read, "POST 20, DESCEND NOW TO"

The pilot . . . to descend now to FL 240.

January 1976—2nd paragraph, last sentence change to read ". . . ADVISE YOU CLIMB TO (ALTITUDE) IMMEDIATELY."

March 1976—Delete 1st Question and answer under Lost Communications Enroute (See September 1976 article for correction.)

August 1976—Change answer d. of question 10 to read, "All of the above."

September 1976—Change next to last paragraph to read, ". . . 4. Instrument maneuvering (normally 1.4Vs) 5. Final Approach (Normally 1.3Vs) 6. Landing (Normally 1.1Vs)" ★

NAME THAT PLANE

Northrop XP-56 (First flight Sept. 6, 1943)
Take off weight 11,350 lbs.
Max speed 467 mph,
cruise speed 375 mph.
Range 450 miles, service ceiling 33,000 ft.
Armament—(4) .50 cal guns, (2) 20 mm cannon.
Power—1 P & W R-2800B, 2 Curtiss electric counter-rotating propellers.
First all magnesium, all welded airframe in history.



Two Tales

LT COL HELMUT OBERBRINKMANN, GAF
Directorate of Aerospace Safety



The two narratives that follow are true stories. They show how easily human failures, sometimes caused by shallowness, carelessness, ambition or vanity can lead into incidents or disaster.

After a flight with a twin engine jet, the pilot in command wrote up the nr 2 engine oil pressure and one of the ground crew commenced straightaway with troubleshooting. With reference to the entry in the Form 781, his first step was interchange of the pressure gauges, because he was a smart man. After engine check, he found out that only the instrument had failed and not the whole system. Therefore, only exchange of the instrument became necessary and that was the instrument mechanic's job.

On his way to the hangar, after shutting down the engine, he met the instrument technician. Without mentioning the gauge exchange, he told him in passing, "Triple X has a write up for false oil pressure gauge indication on the nr 2 engine." Now the instrument mechanic took a new gauge, hurried to "Triple X" and replaced the nr 2 engine oil pressure gauge. After a new operation check, he signed off the discrepancy in the Form 781. The next day "Triple X" was technically released for flight. A new aircrew took the aircraft and noticed during runup on the runway that the nr 1 engine oil pressure was higher than the upper limit, so the mission was aborted. The pilot now remembered having read the write up on the nr 2 engine due to oil pressure malfunction from the day before. He left the aircraft shaking his head and had a strong discussion with the ground crew.

In this case shallowness and carelessness and extremely bad teamwork led to the incident. I guess all pilots know and all technicians should know that a well-qualified and conscientious working technician-crew is better for aircrews and passengers than the best life insurance.



The second story may demonstrate how dangerous human vanity can be. The incident occurred to a European NATO pilot.

For some reason—maybe it is tradition for some well-educated men of west European kingdoms—it is a habit to wear a moustache, and some men place a high value on its proper maintenance. To do this, our pilot used a special hair balsam. With his so-attended moustache the pilot did his preflight and oxygen system check with his oxygen mask on. While he was checking the 100% supply, the greasy moustache became connected with pure oxygen and ignited, causing facial burns.

This case demonstrates as well that it's not the procedures that are wrong, but, rather, the man. Pilots and technicians will be instructed early in their careers that oily and greasy objects combined with pure oxygen lead to explosion and fire. Therefore, learn your lessons and keep yourself under control at all times. To avoid human failures, make the words of a famous European statesman your motto:

CONFIDENCE IS GOOD,
CONTROL IS BETTER. ★

616 SQUADRON

In your issue of July '76, MSgt Sylva writes ". . . Germany produced the only operational jet fighters of the war. . . ."

If MSgt Sylva is as interested in military history as your writeup following his "The Air Force Story" indicates, he will be very interested to know that The Royal Air Force also had an operational jet fighter in WWII.

616 Squadron, RAF, was operational with the Meteor in the summer of 1944 and scored many successes against the V1 "Doodlebug" beginning in August of that year. 616, I believe, lays claim to being the first operational jet squadron in the world; a claim with some validity, the Luftwaffe being unable to use the Me 262 as a fighter initially because of Hitler's insistence on its use as a bomber. A 262 squadron was only formed in early '45 as a last ditch effort.

Capt WJ McWilliams
Canadian Forces Base Europe
CFPO 5056

"DON'T BREAK THE GLASS"

The article "The IFC Approach" in the September 76 issue of *Aerospace Safety* dealt with the problem of blocked pitot and static systems. I found the article most interesting and informative, but I must disagree with one of the recommendations.

Please don't try to break instrument glasses!

Long ago I was flying night fighter Mosquitos in the other Canal Zone. One dark night I was climbing over the equally dark Sinai desert when I realised that all was not well with the pressure instruments. I deduced that the static line was restricted and was becoming more so (my mental processes are not outstanding; I simply had 90 minutes fuel left and I knew the Mosquito pretty well—time and experience were on my side).

mail call

Send your comments and questions to:
Editor, Aerospace Safety Magazine
AFISC/SEDA
Norton AFB, CA 92409

In accordance with the current teaching, I asked my navigator to break the VV1 glass with the point of the crash axe. He made a couple of blundering attempts—he had to use his left hand—before I snatched the axe from him and had a go myself. On my third attempt the axe bounced off the glass and went through the attitude indicator. Long silence!

Fortunately at that time we used to practice patterns using power versus attitude, exactly as described in your article. Fortunately, again, in those days the pilot had no scope to blind him so I was able to discern the horizon sufficiently well to be able to get safely to the longest runway within range.

The lights on the airfield and in the Nile Delta gave me sufficient attitude reference to apply the approved technique and I knew that the airspeed indication would be near correct at low altitude; nevertheless I added a few knots because that would be opposite to any likely error. It worked!

I don't think my boss, and his boss, really believed my tale. They didn't say much, but the Wing Commander had the VV1 extracted from the aircraft and then attacked the glass with a ball pene hammer. Fortunately, yet again, it kept bouncing off the glass and I was able to sneak quietly away before he hurt himself.

The cause of the problem was a bug which makes a nest of rotten vegetation in small tunnels. We found some part finished nests the next day in other aircraft—it must have been the mating season.

What did I learn?

a. Relevant to the article, the first noticeable effect of blocked static during the climb is a reduced rate of climb, not a reduction of airspeed. You try to maintain the normal indicated speed but as a result of the higher (lower level) static pressure you are carrying you fly too fast and the climb rate is lowered. A blocked pitot source will give the same effect, but in this case because you are actually flying slower than intended.

b. An ILS or GCA approach would be better, even in VMC, because deviations from a smooth flight path would be more apparent. I believe we never had GCA or ILS in Egypt, probably because it was CAVOK for 364½ days a year—and it was a long time ago.

c. A formation lead would be best, but as lonely night fighters we did very little formation practice.

d. Assume all instrument glasses are designed for pressurised cockpits, as mine was; I believe most pressure instruments are nowadays, for standardisation in production and supply. And anti vibration mountings give a good trampoline effect.

e. Navigators are not always stupid—sometimes the axe is in the other hand!

f. This is the one case where in an emergency you don't break the glass.

g. Finally, don't relax until you're out of the aeroplane. Taxiing back, greatly relieved, from this incident I very nearly collided with another aircraft on the unfamiliar ramp.

May I just add that we find *Aerospace Safety* a most useful and interesting publication and, as you can see, it is very widely read.

Group Captain W E Kelly
Headquarters Strike Command
Royal Air Force High Wycombe
Buckinghamshire ★

OPS TOPICS

STUCK SWITCH

An F-4 crew used cartridges for engine start when scrambled in support of a local exercise. Everything was normal through the ground exercise until the crew noticed that the lox gauges were reading zero. The aircraft was shut down, written up for lox servicing and then recocked. About 4 hours later when the AC attempted to verify the status of the lox by moving the nr 1 engine master switch to on for electrical power, the nr 1 starter cartridge fired. The engine start switch had stuck in the left engine position during the previous cartridge start. The moment electrical power was applied through the master switch it fired the cartridge.

THEY'RE EVERYWHERE

A T-39 was making an approach to a western air base in a dense traffic area. The visibility was about 3 miles. As the T-39 was on glide path (about 5 miles final), the radar final monitor called out traffic at one o'clock. The pilot saw a light aircraft co-altitude traveling in the opposite direction. The aircraft passed off the wing about 300 feet away.

IF YOU DON'T KNOW—DON'T

The KC-135Q crew was tasked, as part of their mission, to deliver a NORS part to another base. Since the crew chief would not be going and the crew was not familiar with the fuel system, the crew chief briefed the crew briefly on how to refuel before departure. After the aircraft landed at the transient base, the number 2 refuel valve switch, located on the copilot's panel, was placed in the open position by the copilot. Positioning of **this switch** had not been discussed with the crew chief before departure, but the crew thought this valve corresponded to the manual refueling in the right wheel well and it should be open to refuel through the left SPR. The proper position should have been closed. Next, the boom operator told transient alert personnel to top off the main wing tanks and that fuel flow would stop automatically when the tanks were full. The boom operator indicated no one would be in the cockpit. Tech orders were available but instead the TA crew relied on the boom operator's instructions. Transient maintenance personnel connected the fuel to the left SPR and began to transfer. The fuel was routed through the open number 2 valve into the aft body tank. No cockpit fuel panel monitor was available to detect the fuel flow to the incorrect tank. The tail support strut had not been installed as required. After 25,000 pounds of fuel had been transferred into the aft body tank, **the aircraft settled on its tail** with $48,870 worth of damage.

NEW TRAINING SYSTEM (MUTES)

ASD has developed a new training system for air combat called Multiple Threat Emitter System (MUTES). It is a computer that simulates signals generated by enemy radar, missile and weapons complexes. The advantage to MUTES over previous systems is the realism that MUTES can transmit five different signals at once. This allows the Air Force to simulate a true combat environment when the crew is faced with numerous hostile threats simultaneously. The MUTES is a highly adaptable system. As new threat parameters are discovered, all that is necessary is a computer programming change. The system is now undergoing OT&E at one of SAC's radar bomb scoring sites.

OPS TOPICS

CHANGES TO THE NOTAM SYSTEM

During the past several months, there have been some changes in the NOTAM System. Anyone flying now is aware of the new hourly update system. This system has given us some real benefits in terms of error reduction and expeditious posting of NOTAMs. One other innovation of particular interest to pilots is that bases establishing prior permission required (PPR) status are requested to include an AUTOVON number for contact as part of the NOTAM. In other changes, the European and Pacific NOTAM facilities will be deactivated and the Central NOTAM facility at Carswell will assume worldwide responsibility. This action will be complete by April 1977. Further into the future, crews can look for elimination of the present NOTAM boards. Instead, computer and high-speed printer systems will prepare a printed copy of requested NOTAMs for the aircrew.

QUESTIONABLE ABORT

A three-place flight of A-6Es was aligned in starboard echelon on the 150-foot-wide runway. Clearance for takeoff was received and the leader on the far left side of the runway began to roll. Prior to this the leader had switched the flight to departure control frequency. No radio checks were conducted on departure control. Just before the leader commenced his takeoff roll, he had switched his UHF to the squadron base radio frequency to give the SDO a takeoff departure call.

After 5-10 seconds of takeoff roll, the leader elected to abort because of a left generator failure. He transmitted "505 is aborting." This was SOP and should have alerted the other two aircraft as to the leader's intention. However, in this instance, the leader had neglected to switch back from the base radio frequency to departure control. Therefore, his vital transmission was not heard by the other two aircraft. Number 2 who was lined up on the centerline of the runway, waited 5 seconds after the leader commenced to roll before commencing his takeoff. At about 80 knots, No. 2 noticed he was closing on the leader and reduced power 2 or 3 percent. Shortly thereafter, he realized that No. 1 was aborting and he decided to abort also. He transmitted: "503 aborting, too." When it became obvious that he was going to overtake the leader, No. 2 moved slightly to the right to ensure wingtip clearance.

Number 3 did not receive No. 2's abort transmission and began his takeoff roll 5 seconds after No. 2. At 95-100 knots No. 3 noticed a slight closure rate on No. 2. Almost immediately No. 3 realized that the leader and No. 2 were aborting. He too was committed to abort as No. 2, having steered right to avoid the leader, was a hazard to No. 3's takeoff. Existing weather was good and the loss of one generator was not considered an extreme emergency requiring an immediate abort. Additionally, consideration should have been given as to what effect the leader's abort would have on the other two aircraft taking off.—*Weekly Summary*/10-16 October 1976.

CORRECTION

In the November issue the OPS TOPIC "Too Much Trouble" contained an error in type of aircraft. The type was a CH-53 owned by another service not an ARRS HH-53.

OPS TOPICS

INVISIBLE TORNADO

You have all heard of the "white tornado." How about the "invisible tornado?" During the last 5 years, there were 76 accidents and 19 deaths caused by wake turbulence. For you new folks in the flying business and any old timers who are still nonbelievers, here is a little story from an NTSB Safety Bulletin:

The Cessna 150 was on downwind to Runway 5R with the student pilot flying, when the instructor observed a KC-97 on short final and another KC-97 about 7 miles out. The instructor requested a short approach between the two KC-97s. The tower cleared the Cessna for the short pattern and cautioned about wake turbulence. At about 200 feet the Cessna encountered wake turbulence from the landing KC-97 and began to roll—first to the left and then to the right. The instructor added full left aileron and full power. The wings started rocking uncontrollably with the left wing low and the aircraft drifted swiftly to the right in spite of all the instructor's efforts. The Cessna's left wing tip struck the ground; and the aircraft slid to the left and forward. The nose gear sheared and the aircraft slid to a stop. The occupants were uninjured but the aircraft was badly damaged.

WHAT RADAR DOESN'T DO

The crew of an AC-130 was cleared by RAPCON to descend from 9,000 to 6,000 feet MSL to commence multiple GCA approaches. While passing through 7,500 feet MSL, the crew saw a light aircraft passing over the top of the AC-130, missing the aircraft by only 50 feet. An immediate call to RAPCON confirmed no reported traffic in the area and **RADAR SHOWED NO TRAFFIC.**

A MATTER OF PRIORITY

Recently, an official USN message carried the following report of rescue operations involved in a major flood. "During the 4 days and nights of operations the SAR helos from NAS Northwest evacuated 108 people, 8 dogs, 2 cats and 5 marines."—*Approach*/November 1976

COLLISION COURSE

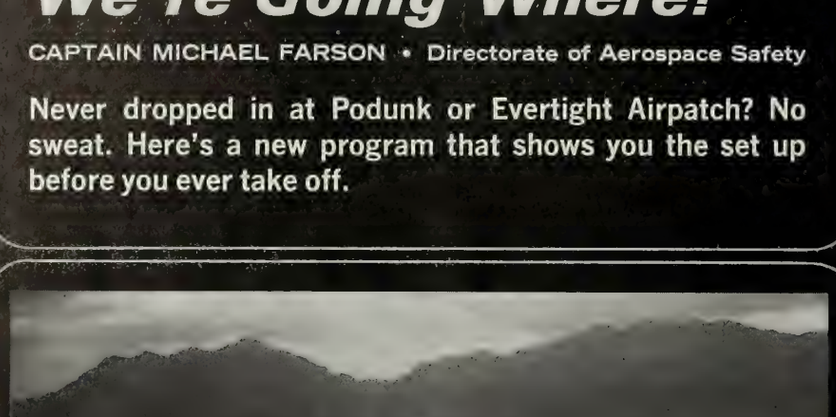
A formation of nine C-130s was making a VOR approach to Runway 34 and was level at 5,000 ft. A locally based KC-135 was cleared to hold at the IAF and then, as the aircraft approached the fix, was cleared for a high TACAN to Runway 34 to maintain 6,000 MSL. The KC-135 pilot acknowledged the clearance but failed to acknowledge the altitude restriction. Approach Control then issued clearance to a transient T-38 for a straight-in TACAN approach to Runway 34. The KC-135 pilot copied the clearance meant for the T-38 and read it back to Approach. The Approach Controller failed to catch the mix-up and advised the KC-135 of the C-130s at 5,000 ft. The C-130s were also advised about the KC-135 that would be passing at 6,000 ft.

The pilot of the KC-135, believing he was cleared to descend, narrowly missed the nr 2 C-130 at 5,000 ft. At the time of the near miss, Approach Control was working two sets of aircraft with the same two digit call signs. This may have prevented the controller from recognizing the pilot's error in not fully identifying himself when acknowledging a clearance. When using a call sign be sure it is complete so that you will be positively identified. ★

We're Going Where?

CAPTAIN MICHAEL FARSON • Directorate of Aerospace Safety

Never dropped in at Podunk or Evertight Airpatch? No sweat. Here's a new program that shows you the set up before you ever take off.



Kaneohe Bay MCAS, Hawaii



Runway 31, NAS Alameda, California



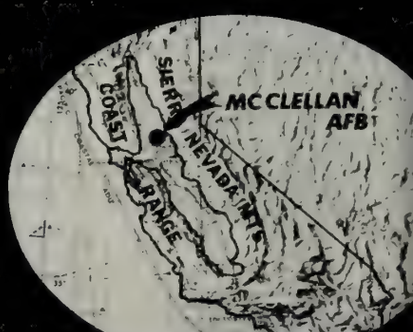
Runway 21, Kirtland AFB, NM

"Hey Jack, where are you headed "Barbers Point." "Say Joe, ha you ever been there?"

"No, but I hear they have this slide ta program at the Operations Center that te about the field."

That's right guys. You're talking abo MAC's Airport Qualification Program (AQP This is MAC's way of trying to reduce t risks associated with operating into unf miliar airfields. The AQP was conceived as result of the C-141 crash at La Paz, Bolivi MAC training developed the program to pr vent similar accidents by increasing the ai crew's awareness of potential airfield ha ards. A slide-tape module was chosen as t most cost effective way to brief those ha ards to aircrews.

The standardized program begins by d scribing the airfield location, listing alte nate airports, and highlighting hazardous te rain and obstacles. Then, significant airpo characteristics such as possible illusion taxi hazards, and unusual local weather ph nomena are covered. The program conclud with sequenced photographs taken on fin



AQP package contains charts showing pro nent terrain features.



Also possible hazards near runway are shown.

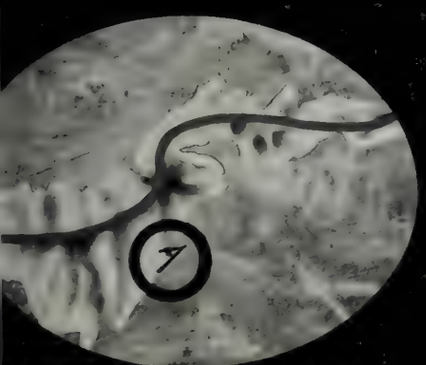
pproach to each landing runway and usual-
y lasts from 5 to 10 minutes.

Currently, MAC has selected approximately 20 airfields for production, and 30 of these rograms have been completed. The rated fficer producers are quick to point out that hey aren't trying to tell crews how to fly pproaches. They merely want to make crews ware of the threats in the airfield environ-nent.

The AQP modules have great flexibility. hey can be incorporated into local and sim-lator training programs. They also provide seful information prior to unit deployments, xercises, or contingency operations. MAC lans worldwide distribution of these pro-rams, along with easy access to them so hey can be reviewed whenever a crew re-uests.

The Airport Qualification Programs are vailable upon request through the USAF Central Audiovisual Library System distribu-ion system.

Should you include this program as a ecessary part of your accident prevention lan? The 5-10 minutes invested may indeed e time well spent. ★



elationship of runways to hills is shown for is base.



ard runway depiction.



NAS Alameda in San Francisco Bay. Runway 7-25.



Throttles retarded, spoilers deployed, nose up pitch . . . the C-141 still was descending at 8000 feet per minute . . . it was a . . .

Wild Ride in a Big Bird



Events of the past year in both civil and military aviation indicate a need for reminding aircrews of the vicious nature of thunderstorm weather and the need for its avoidance.

Our educational campaign began with the article "Low Altitude Wind Shear" in the October issue. Following is a first person account from the October 1969 AEROSPACE SAFETY magazine of a C-141 encounter with a violent thunderstorm over the Pacific. The author was Capt Charles L. Pocock —now Lt Col Pocock, C-141 project officer in the Directorate of Aerospace Safety.

The wheels folded into the belly of the giant C-141 as we started turning to 090 degrees, heading out over the long white beaches and away from Danang. As the blue-green South China Sea fell away, the hurrying ships, airplanes and men of busy Danang once again seemed far away.

The 30,000 pounds of filthy and broken retrograde cargo in this giant silver bird seemed strangely out of place. The ten, perpetually tired, sweat soaked marines in their green utilities basked in the air-conditioned comfort and started to look for a place to sleep. These men who had come to this green hell a year ago as boys now started to think 24 hours ahead to when they would be home.

An hour later, we received clearance to climb from flight level 270 to 370. As the pulsating engines started to grasp for altitude again, we entered solid cirrus clouds at FL 290. At level off, the cirrus was so dense that the radar was giving returns from only about six miles ahead. The navigator assured me that the radar was functioning, but dense ice crystals were preventing returns.

The VHF radio was now totally unusable and the HF radio was little better. Other aircraft, on UHF, Company frequency, advised that the cirrus extended from below 20,000 feet to above 41,000 feet. As we pressed on, I knew that the typhoon



moving north from the Philippines was going to cause problems until we were well north of Okinawa.

Kilo Whiskey (KW) beacon was the next fix. World 397 had just advised Taipei Control that he would be deviating 30 miles south of track for thunderstorm avoidance, but I didn't have any idea where he was. I hoped our radar would give us some warning if the storm was on our track.

Ten minutes south of KW, we encountered moderate turbulence. I turned on the continuous ignition, retarded the throttle three hundred pounds fuel flow per engine, disconnected altitude hold on the autopilot, and announced on the PA system that everyone should fasten their seat belts.

"What do you see on your radar, Nav?"

"Nothing."

Immediately the airplane was in a 60-degree bank. The attitude indicator showed 30 degrees nose up pitch. The vertical velocity indicator and altimeter were climbing and the airspeed was falling rapidly. I disconnected the autopilot, pushed forward on the yoke, and when the dot on the attitude indicator was approaching the horizon line, rolled the aircraft level. The throttles were at takeoff rated thrust and even though I had 10 degrees nose down pitch, the vertical velocity was still indicating an 8000 foot per minute rate of

Wild Ride in a Big Bird

continued

climb with 200 knots airspeed.

Milky rime ice was building up rapidly on the airplane and the hail sounded like skeletons on a tin roof. Lightning and Saint Elmo's fire made the whole airplane sparkle and everyone's hair was standing on end.

The turbulence was so bad, I thought the instrument panel was going to shake off. I locked the shoulder harness and pulled the straps tight. That helped a lot. Holding the airplane with my left hand, I started swatting at anti-ice switches with the right, hoping I could get enough on before we fell out of the sky.

As the altimeter went through 43,000 feet, I realized we had been in the storm for about 20 seconds and the way out was behind us. I started a left 15-degree bank. As this 125-ton monster grudgingly responded, the noise from the hail was deafening.

The navigator called out, "Slow the airplane down before we peel the radome off."

And the engineer announced, "You're overboosting the engines and we are almost at stall speed."

I knew that more than 15 degrees of bank would probably stall the airplane. But I didn't want to use more than 10 degrees nose down pitch because we would probably be in the down cell momentarily. The windshields now had iced over except for about nine-inch squares in the center of each.

As we passed 48,000 feet, we started to descend, more suddenly than we had started to climb. Everyone was hanging by his seat belt. Briefcases, tech orders, oxygen masks, pencils and anything else that wasn't tied down was on the ceiling and floating through the cockpit. I knew we had changed cells from the updraft to the downdraft and immediately pulled back on the yoke.

As we went from 10 degrees nose down pitch to 15 degrees nose up, the overspeed warning sounded. I had the throttles retarded and the spoilers deployed to the flight position, but we still had 8000 feet per minute rate of descent with 15 degrees nose up pitch. We were now on a reciprocal heading from which we entered this storm. I rolled the wings level and hoped we would soon be out.

The navigator said, "Why are we in a 45 degree bank?"

Again I felt the adrenaline surge and replied, "We're not."

"Look at the copilot's attitude indicator and HSI," he said.

As I glanced across the cockpit, the realization that one set of instruments had failed almost made me sick. (For some reason, the thought passed through my mind: I wonder if the Marine Corps taught these kids to swim.)

I made up my mind to follow my instruments come what may. I checked my BDHI and saw that it was indicating a turn from west to north (if that was true, we were going right back in the storm). But I thought the copilot's attitude indicator said left bank. Quickly I glanced across the cockpit. Left bank and right turn—his instruments have failed and mine are OK. I felt better now and went back to other immediate problems.

Still high airspeed, but slowing, still 4000 feet per minute with nose high attitude, but not nearly so rough. Heading pretty close to south—we should be out soon. We better be—now 22,000 feet. Then as rapidly as it began, it stopped. We were in smooth air once again, now at 19,000 feet and below the cirrus.

As the ice started to sublimate and peel off, I slowed to about 220 knots and began a slow VFR orbit. We began to make a damage assessment. Luckily, our passengers had their seat belts on and the cargo had been well secured. The copilot had been in the lower bunk. He had his seat belt fastened and remained there throughout the encounter with the thunderstorm. That was a good thing, he might have been injured.

The navigator checked the tail surfaces with his sextant and they appeared to be undamaged. We found no damage to the leading edge of the wings or to the engine nacelles and the radar seemed to be working normally now, so I knew the radome was intact. The copilot's attitude indicator was still locked in a 45 degree bank, but seemed to be slowly correcting. The Nr 2 C-12 compass had failed, but by placing the mag/DG switch to DG and slaving it to the correct heading, we were able to re-engage the autopilot.

I requested and received clearance from present position, somewhat south of KW, to Kadena at FL 190. As we started northeast toward Kadena, we could see the bottom half of this fearsome adversary. It was about 70 miles in diameter. This time we passed well clear.

As we approached Kadena, they reported thunderstorms with heavy rain, so I elected to proceed straight on to Yokota, our original destination. Although the crew and passengers were obviously shaken, that big, beautiful airplane had come through unscathed. The flight recorder indicated that design limit loads had been exceeded twice but examination proved that no elastic limits had been exceeded.

I have always respected thunderstorms and given them a wide path, but after this experience whenever the weatherman mentions thunderstorms he has my attention—right now! ★



DEBRIEFING

A STEP IN THE RIGHT DIRECTION

FRED C. MUELLER • McDonnell Field Service Engineer

This story relates to an incident which emphasizes that very important ingredient in effective maintenance—communication between people who fly airplanes, and people who keep them ready to fly. This vital link, in more simple terms, is called "debriefing."

The need for good, effective debriefing is amplified when we are confronted with repeated inflight discrepancies that cannot be duplicated on the ground. When problems like this arise, the discussion of the problem between two professionals, a pilot and a maintenance man, usually becomes the primary source of information with which to confront the problem. This focus on "communication" is what debriefing is really all about.

Some time ago we ran into a recurring compass error problem on one of our Phantoms. The initial discrepancy was a write-up that indicated an inflight compass error of approximately 50 degrees. The problem could not be duplicated on the ground; however, a functional check of the compass system was routinely performed. Predictably, everything checked out fine.

The technician tested the sensitivity of the compass transmitter by moving a metal object (in this case, a tool) back and forth under the compass transmitter location (Door 197). The compass did not appear to react to this stimulus. On the strength of this check the compass transmitter was changed. The aircraft was then taken to the compass rose and calibrated.

The aircraft flew one good flight but the problem repeated again on the next flight. Moisture was found in the compass transmitter electrical connector on the aircraft wiring side. The connector was dried out (or so we thought) by blowing shop air into it.

A couple of good flights later the problem cropped up again; once more moisture was noted within the connector. This time gaseous nitrogen was used to dry the connector. The compass transmitter cable was reconnected, the aircraft stood overnight, and the next day moisture was again found in the connector. Again we went through the drying process, only to have moisture reappear a few hours later. Eventually the connector was replaced.

The airplane flew trouble-free for several days, and we thought the problem had been whipped. But sure as the sun comes up in the



". . . debriefing is where the money is in the maintenance game." Crew above, at George AFB, is surrounded by debriefers intent on getting accurate account of any discrepancies discovered by the crew.

morning, the original trouble (a 50 degree compass error) popped up again, although replacement of the connector seemed to have resolved the problem of the moisture in the connector (exactly why we kept finding the moisture remains one of those unsolved mysteries).

At this point we steered away from the compass transmitter and began checking the other system components. By the time we were done we had replaced each and every component in the system at least once besides running these components across the test bench. At the same time, several more good flights were recorded on the aircraft only to find the compass error cropping up again.

By now you're probably wondering why we were engaging in apparent "shotgun" troubleshooting. Why couldn't we pin the problem down to a more specific area? The answer is that we simply did not have, at any time, a good, clear, and concise picture of what the discrepancy was. All we had were the aircraft write-ups which simply informed us that the compass was off a certain number of degrees (the amount of the error varied from flight to flight). Though the aircrews were debriefed after each flight, no good, usable information was gathered. Debriefing forms were dutifully filled out (the yes/no questions were checked off, etc.), but the remarks area did not contain that extra bit of information that would help us analyze what was actually happening during the flights.

We finally arranged for a special flight of the aircraft. The aircrew was briefed before the flight, and then was debriefed following the flight. A special checklist was developed for the aircrew to use as a guide for checking out the system. A wealth of information was accumulated during the aircrew debriefing—data from which we were able to ascertain, with reasonable certainty, that the compass transmitter signal was being interrupted.

How was this determined? We found that the compass reading remained unchanged in the compass mode and the error remained constant in the slaved mode. In addition, the error varied with the number of degrees of any turn in the DG mode, and the compass could not be synchronized with the sync indicator needle remaining centered at all times. This was a reasonable indication that there was no compass signal from the compass transmitter. The fact that the sync indicator needle would not go off center seemed to bear this out. The only movement of the compass indicators seemed to come from the gyro source, but none was evident from the transmitter.

Armed with this information, we found the rest of the trouble analysis (and solution) to be easy. All three legs of the compass transmitter signal were found to have loose splices in the CF-3 splice area. The wires were respliced, and the problem was solved.



Is it possible that this story might have had a different complexion if the full data had been made available during the first debriefing? Maybe that might be indulging in rather pointless speculation; however, I believe we can say that it was, in the end, debriefing-type information that enabled us to resolve the problem.

Our point: debriefing is "where the money is" in the maintenance "game." Inadequate debriefing costs time and money; effective debriefing provides important savings. It's your move.—Product Support Digest

The mission is over—not quite. Whether it was a long, tiring overseas flight or just a quick out-and-back to the range, there's one more thing—maintenance **debriefing.** Okay, so let's take a look at this subject from the positive side. First is the question of the value of the debriefing, which can be answered very briefly: It depends on the amount of smarts and effort put into it. Assuming a lot of both, the debriefing can be a definite contributor to both corrective and preventive maintenance.

What are the ingredients of a good debriefing? Here are some ideas supplied by debriefers of the 4th Tactical Fighter Wing which operates F-4s.

- Aircrews should go directly from their aircraft to debriefing. The debriefing section is manned and programmed to debrief aircraft/aircrews in the order they appear on the printed flying schedule. Delays in reporting to debriefing sometimes cause bottlenecks for other crews, debriefers and the accomplishment of required maintenance actions.

- If all debriefing stations are filled when the crews arrive, they should be seated in the lounge and use the waiting time to double check takeoff and landing times and discuss system malfunctions within the crew. They should avoid talking to crews already in the process of debriefing. These conversations lead to confusion and omissions.

- Aircrews should be thoroughly knowledgeable of all facets of their responsibilities with respect to the 781 and 781H with particular emphasis on takeoff, landing and flight duration times. Incorrect entries will reflect erroneous aircraft utilization and corrections waste manhours. It is absolutely essential that flying time recorded by maintenance and operations agree.

- Both aircrews and debriefers should review all open writeups in the aircraft forms prior to entering system discrepancies in order to avoid duplicating existing entries.

These techniques are considered as "openers" to the detailed discussion that should characterize the debriefing procedure. Debriefers are usually the leaders in this exchange as the standard debriefing checklist is being followed. Additional questions from the debriefer reflect his knowledge of current failures and corrective actions.

Aircrews should "listen up" and participate. This is a real opportunity to ensure that total systems interrelationships are thoroughly understood by the debriefers. Aircrews should also keep in mind that additional specialists can be rapidly dispatched to debriefing (including specially formed groups such as flight control teams). The maintenance debriefer has extensive knowledge in specialized areas, but may need help in total systems integration and analysis. The debriefing process should not be rushed. If effectively accomplished, it will save many mandays of valuable labor. ★

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AIR FORCE

A great way of life.



SMSGT DAVID BUZARD, Air Weather Service, Scott AFB IL

You've just "completed" a trying flight, circumnavigating thunderstorms en route, shooting an approach to minimums, and landing a hot jet on a slick runway. All you had to do was finish your rollout and taxi in. Why, then, are you sitting dazed beside the runway in a busted bird? Because you lost control of your aircraft and slid off the runway—that's why.

IR08, WR//, SLR16P DRY, LSR-18, RCRNR, PSR12 SANDED

Do the above characters, letters, and numerals mean anything to you? As a pilot, you should recognize this sampling of the many runway surface conditions (RSCs) and runway condition readings (RCRs) which may be appended to USAF surface weather observations when transmitted over global weather circuits. Did you know that weathermen do not determine RSC and RCR?? You didn't!! Well it's a fact—they do not. The determination of RSC and RCR (as applicable), when runways are partially or completely covered with water, slush, ice, or snow, rests with the Chief of Airfield Management.

The role that weathermen play is in the **dissemination** of RSC and RCR data: They include the RSC and RCR report in verbal aircrew weather briefings, to include appropriate ramp/taxiway data.

When the RSC and RCR report is received from base operations, weathermen transmit the report via global weather circuits as a remark either in a single element report or appended to a Record or Special surface weather observation in progress. They then continue to append the RSC and RCR report to hourly observations until the data are amended or cancelled by base operations, or until base operations closes at a limited duty airfield. When base operations closes, "RCRNR" (indicating no report) is appended to the hourly surface observation. (This remark may be omitted if the runway is known to be completely dry.) "RCRNR" is discontinued when base operations reopens. The RSC and RCR data are not included on surface weather observations when disseminated to local (on base) using agencies.

The RSC/RCR reported relates to the present condition of the runway and not always to the present weather condition and temperature reported in the surface weather observation. Therefore, as a pilot, if you keep abreast of your destination weather, you aren't surprised when you land under a 5,000 foot scattered deck, 15 miles visibility, with no weather or obstructions to vision reported and still have a wet runway under you.

For those of you who couldn't decipher the RSC and RCR remarks at the beginning of this article, the following is provided:

IR08— Ice on runway, decelerometer reading 8.

WR//— Wet runway (decelerometer readings are not reported for wet runway conditions.)

SLR16P—Dry slush on runway, decelerometer reading 16, patchy; remainder of runway is dry.

LSR18— Loose snow on runway, decelerometer reading 18.

RCRNR— Base operations is closed; a RSC/RCR report is not available.

PSR12 SANDED—Packed snow on runway, decelerometer reading 12, runway has been sanded. ★

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TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.





CAPTAIN
Robert G. Downs

CAPTAIN
Robert S. Coombs

366th Tactical Fighter Squadron
4th Tactical Fighter Wing
Seymour Johnson Air Force Base, North Carolina

On 8 April 1976, Captain Downs, aircraft commander, and Captain Coombs, weapons systems officer, were flying a training mission in an F-4E. Although no thunderstorms were forecast and no evidence of heavy precipitation was seen on the aircraft's radar scopes, the aircraft rolled and yawed and the crew heard two loud "cracks" and saw a bright flash of light. Although in the weather, Captain Downs was able to maintain formation, disengage stability augmentation, and check engine instruments and attitude indicators. All three systems were in disagreement and the associated heading systems were spinning. Unable to maintain formation position, Captain Downs initiated lost wingman procedures, rechecked engine instruments and noted the right engine unwinding to 60 percent rpm. The airspeed read zero, vertical velocity was frozen at minus 500 fpm, the altimeter was stuck at 6000 feet, and the AOA indicator was frozen at 9 units. After two airstart attempts the right engine recovered. Captain Downs selected afterburner, centered the turn needle and ball, and started what he felt was a climb to VMC. The VVI still read minus 500 fpm; but the altimeter began to increase erratically. The rear ADI was close to being logical but still could not be trusted. Captain Downs began to orbit for a rejoin but could not maintain VMC. Afterburner was selected once more and another climb initiated. With assistance from Approach Control, Lead acquired a radar contact and was able to confirm Captain Downs' airspeed and heading from a 10-mile trail position. Following rejoin in VFR conditions, Lead advised Captain Downs that an 8-inch by 4-feet piece was missing from the top of the vertical stabilizer, but otherwise the aircraft appeared undamaged. Penetration and approach on the leader's wing was accomplished with a drop off on short final for a single ship landing. The teamwork and professional airmanship exhibited by Captain Downs and Captain Coombs possibly saved a valuable aircraft and two valuable lives. WELL DONE! ★

The Unessential Man



★ *To his first shirt, he is one of the men that can best be spared for a base beautification detail.*

★ *To his shop chief, he is another piece of paper work.*

★ *To a flight line mechanic, he is some boob to scrounge off of.*

★ *To maintenance control, he is just another body to be deployed wherever needed.*

★ *This is the unessential man. Why is he unessential?*

★ *The unessential man does not forecast weather, replace electrical circuits, control air traffic, or even work on jet engines. All he does is pack parachutes.*

★ *A Parachute Rigger goes to school for several weeks to learn his trade. The government spends a few thousand dollars to train a man to save the life of a pilot worth several thousand dollars.*

★ *The egress system is designed to get the pilot out of a plane. The parachute is that pilot's last chance for life.*

★ *A Parachute Rigger is seldom thought of when there is a successful ejection. The next time a pilot has to punch out of a bird, thank God and your Parachute Rigger when you look up and see a good chute.*

Artie D. Thrower
Luke AFB, Arizona

A Parachute Rigger

.1305
.42

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SAFETY FEBRUARY 1977



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From Phantom To Eagle

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Cover photos courtesy
McDonnell Douglas Corp.

UNITED STATES AIR FORCE FEBRUARY 1977

aerospace SAFETY

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NAME THAT PLANE

THE C-125 RAIDER (1949)

The Northrop C-125 Raiders were three-engined transports built to operate from improvised airstrips as airborne assault vehicles and rescue aircraft. Twenty-three were ordered by the USAF, thirteen as Assault Transports and ten as Arctic Rescue aircraft. The C-125 had a nearly rectangular fuselage to give maximum cargo space and an under-fuselage ramp cargo door to permit the loading of vehicles. These transports were powered with three 1200-horsepower Wright R-1820 engines, each driving reversible propellers. The wingspan was 87 feet, length 70 feet, weight loaded 32,500 pounds. Wheel and ski equipped for operating either on snow or on normal runways, these airplanes were used primarily for Arctic rescue. First assault-rescue type aircraft designed for snow/ground landings with its wheel-ski equipment.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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FEBRUARY 1977 AFPR 127-2 VOLUME 33 NUMBER 2

Readiness

The Chief of Staff designated 1976 as Readiness Year. A most appropriate emphasis in the face of the serious massive shift in the world balance of power over the past decade. Where once the United States was the world's foremost military power, we find ourselves today in a position of approximate equivalence to the Soviet Union. As a free people we tend to neglect defense when potential adversaries are not dramatically threatening our freedom. Thus we have been experiencing repeated reductions in the purchasing power of our defense budget, while the USSR has been dramatically expanding their capabilities as well as refraining from certain of the more flamboyant world acts of provocation which alert democracies to their real objectives and stir our defensive efforts.

What has this to do with Safety and accident prevention? How can we as safety persons contribute to increased readiness? I think the answers are clearly obvious. Our most difficult challenge is how. In 1976 we developed the capability to predict, within a very few percent, how many accidents we would have, which aircraft they would involve and what categories the cause factors would fall into. Encouraging, yes, but at the same time frustrating in that we were subsequently unable to lower the number of these occurrences or significantly change the reasons for them. That was not because all of you did not work hard or were not dedicated to the task, but because we have yet to learn how to effectively and dynamically translate lessons from the past into preventive actions of today, to create a lower experience for tomorrow.

We continue to lessen our potential effectiveness by inhibited communications. In certain instances we appear to be more concerned with our rates than with our real efforts to enhance readiness and maintain the highest combat capability. We hate to be told we've made a mistake or overlooked a rather obvious fact, or followed a faulty logic path, or failed to fully recognize and support someone else's needs.

The cost of aircraft accidents last year approximated the cost to operate an average Air Logistics Center for that same period. The cost of all accidents has, on occasion, approached the level of funds authorized by congress for all modifications to our weapon systems.

Unquestionably our job can have a serious and direct impact on readiness and total combat capability. It is up to each of us to influence those for whom we work —functional managers, and decision makers at all levels—to properly include the safety factor in the management and operational decision equation. We can no longer demand safety for safety's sake alone. Ours must be a studied, unemotional and fresh approach to what is needed to make our weapons systems effective, functional and long lasting. Together we can make 1977 a truly outstanding year in terms of reducing accidental losses. ★

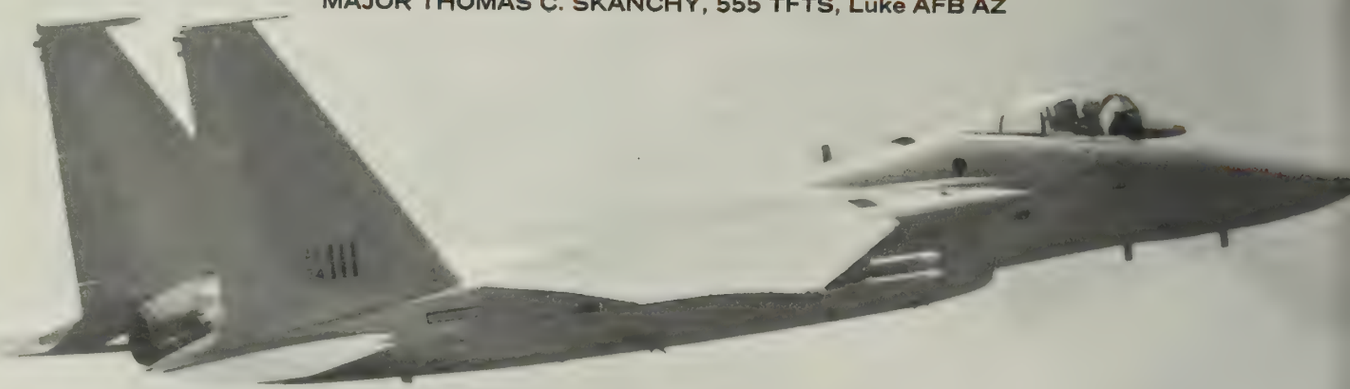
Richard E. Merkling

RICHARD E. MERKLING, Maj Gen, USAF
Director of Aerospace Safety



FLYING THE EAGLE

MAJOR THOMAS C. SKANCHY, 555 TFTS, Luke AFB AZ



After spending nearly a decade in the Phantom, it would be down right dishonorable, not to mention unthinkable, to degrade that superb fighter when comparing it to the F-15A Eagle. Without treading on anybody's toes or injuring the pride of those who care for or fly the Phantom, allow me to make some observations on my impressions when stepping out of one outstanding fighter into another.

For those who haven't had a glimpse of the finest fighter in the world, a quick synopsis of the Eagle would be in order. The F-15 Eagle was designed and developed for one sole purpose, air superiority. True, it has outstanding secondary capabilities too, but let's stick to the primary role.

It is a single-place, fixed wing, Mach 2.5 class twin-engine aircraft that can outperform and outfight any enemy fighter aircraft in the foreseeable future.

The F-15 combines the most advanced fire control system with Sparrows, Sidewinders and gun for optimum combat efficiency, and is capable of carrying conventional ordnance without off-loading any of its air-to-air missiles.

The low wing loading and an excellent thrust-to-weight ratio provide the F-15 with unprecedented maneuverability.

These features, combined with

an advanced electronic system to sort and identify targets and to evade enemy defenses, enable the F-15 to find, identify, engage, and destroy any aircraft expected to be a threat through the 1980's.

Being assigned to the F-15 at an early stage of its introduction to TAC was in itself a very unique situation. To quote the instructor after my first flight in the two seat TF-15, "Now you know everything about the F-15 that I do." The point was that we were in virgin territory, operating the aircraft, not to mention the yet-to-be-developed tactics and concepts for the application of the Eagle. I don't know if I was apprehensive because I was leaving my best friend, the Phantom, for a strange and unfamiliar aircraft, the Eagle, or if I was apprehensive because seemingly the whole world appeared to be watching my every move as a new guy in the F-15. Anyway, I was plenty apprehensive.

Hitting the books was my first order of business before actually setting foot in the F-15. I'll never forget the incredible number of acronyms used with the bird. They seem to sprout out of everything like undergrowth in the jungle. I wore out three glossaries trying to figure out what, for example, JFS, HUD, CC, CDIP, DIL, and FOV stood for not to mention HPRF, IRE, and TEWS. I still find my memory fails me when trying to explain something in the cockpit once in awhile and have to revert to point at that "what a ya call it."

My first flight is etched indelibly in my mind. Could an old dog be taught new tricks? That saying kept going through my mind again and again. The crafty crew chief watched my every move through narrowed eyes as I preflighted his aircraft. He had adequate clues that this was my first flight when I hit my head twice during the preflight and took ten minutes, even with his help, just to strap in. This particular "Eagle Keeper's" name was Sgt Yaple (recently returned to civilian status). I know that Sgt Yaple was sure that his aircraft would never be the same again after I got through with it.

As most of you know, the F-15 has self-contained starting capability. In fact, that is the only way you can start it. The Jet Fuel Starter (JFS) is started by stored hydraulic pressure accumulators. I know the biggest fear of Sgt Yaple (and any other crew chief for that matter) is that the pilot will forget to turn the JFS starter switch on and deplete the JFS accumulators. It takes 400 strokes with a breaker bar to replenish the accumulators if the pilot "screws up" and that is quite a muscle building program, to say the least. Much to my relief and to Yaple's surprise, I started the Eagle without incident, got through all of the seemingly endless pre-taxi checks and got out of the chocks.

With the narrow gear, the bird feels a little spongy at first. The brakes grab a little until you get used to them, but the one item that



The F-15 has a self-contained starting capability. The Jet Fuel Starter is actuated by stored hydraulic pressure accumulators.

Photos from McDonnell Douglas Corp. and TSgt Herman J. Kokojan, formerly assigned HQ AAVS Photojournalism Division.

High idle thrust moves the F-15 right along. Pilot must use brakes continuously to avoid taxiing too fast.









really gets your attention is the idle thrust. Your first impression is that you're taxiing with military power. In this aircraft, you must continually ride the brakes. If you don't, you'll reach a terminal velocity at idle thrust of somewhere around 70 knots.

The first afterburner takeoff is the best. Normally, we do a mil power takeoff, but on this flight, I got to perform a maximum performance climb. I'll tell you, when you plug in those burners the Eagle literally leaps into the air. My first impression was to get the gear up before I sheared them off with the rapid acceleration. A nice four "G" pull puts the bird in a breath-taking 70 degree climb. I will never forget or ever get tired of the "elevator effect" you get when doing a maximum performance climb. It is fantastic to be at 20,000 feet by the end of the runway or maybe a little beyond.

The turn rate and ability to sustain energy really gets your attention. You can haul back on the "pole" at all altitudes at all airspeeds and get lots and lots of G's. Flying around at five, six, or seven G's for two or three minutes at a time can make you want to cry uncle. The younger jocks think they do better at this than us older guys (I'm 37). After a good engagement against a Captain in his twenties, I find that those nearing the middle age can give a pretty darned good accounting for themselves. I found the secret is to keep the younger guys looking over their shoulders.

The avionics are really a quantum jump. The Hughes built pulse doppler radar, a central computer, armament control panel, radar display, and the heads up display are really the heart of the aircraft. It takes a lot of dexterity, a sound knowledge of intercept basics, and good tactics, but the F-15 can whip any aircraft it will run against in the air. One man can more than handle the avionics in this radar. Put an aircraft out there someplace and the Eagle can detect and intercept it at any range at any altitude. Target detection as far away as (I must censor this but it is long range) is very common. Crop dusters are regularly detected and locked up coming back from the air-to-air ranges.

Landing the bird takes a little different technique from the F-4. Instead of just driving it into the runway, you pull the power to idle and flare the aircraft holding it off until it smoothly touches down. You then hold the nose off for aerodynamic braking until about 70 knots. Landing rolls can be very short. It lands just like a Cessna, to be quite frank about it.

We have flown many VIP's since we got the Eagle at Luke. Air Chief Marshall Smallwood of the RAF told me after taking him for a ride that "The Eagle handles just like a Spitfire." Now I know that he just paid the F-15 the finest compliment any fighter pilot could pay an aircraft. I am sure he meant every word of it too.

Back to my first flight. I got the bird back on the ground without incident but made the normal new guy mistakes. You know, I missed check list items, I couldn't find the flap switch, and I couldn't remember the radio calls. Sgt Yaple was there to signal me into my parking spot. He looked a little like a runner in the starting blocks—ready to take off running. Probably,







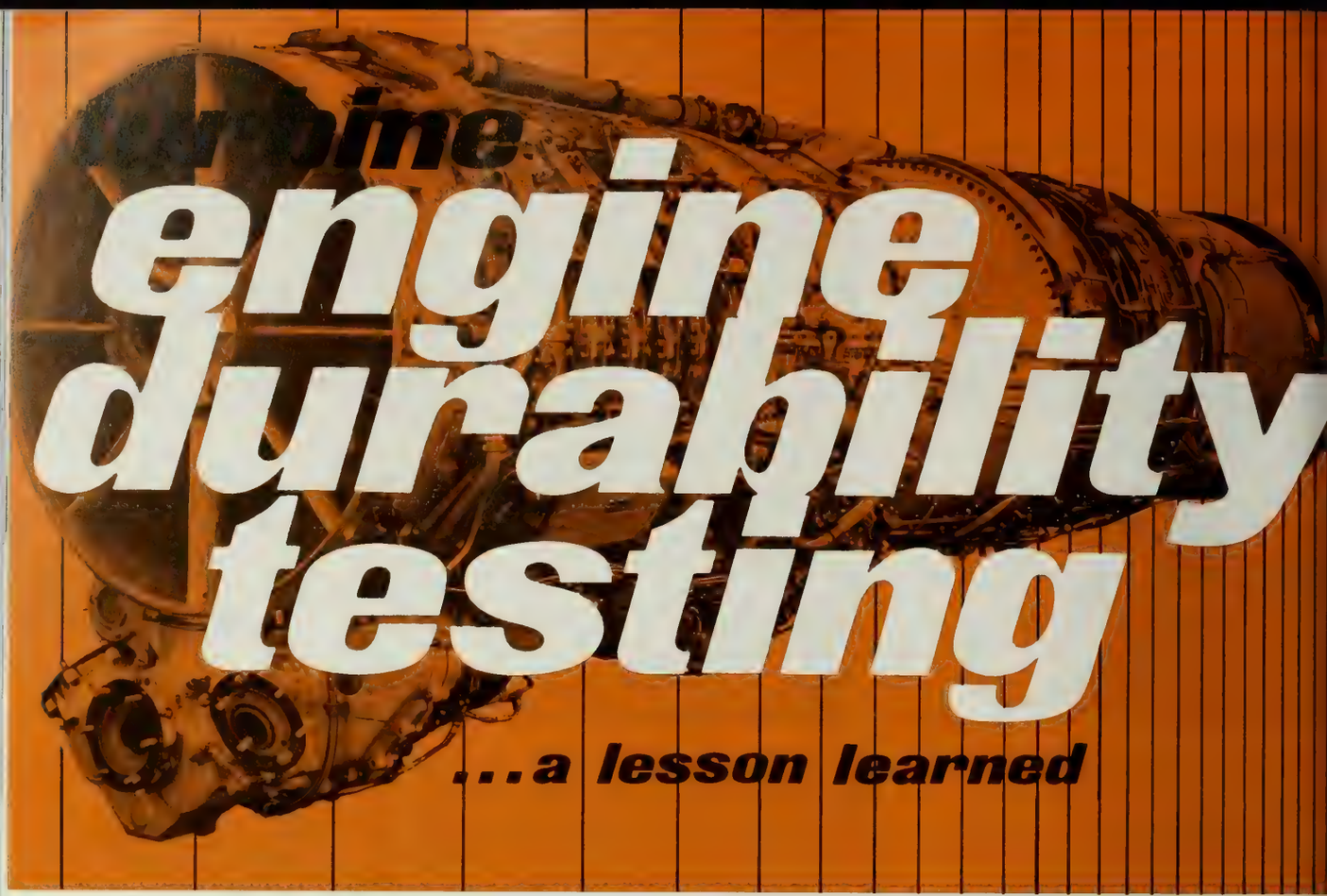
he was a little afraid I couldn't find the brakes. We post flighted the aircraft together. Only after confirming the landing gear was not bent at some new angle and that the tail hadn't been scraped, did Sgt Yaple smile and shake my hand. My IP, Lt Col Gene Thweatt, put in my grade book something I really felt after that first flight, "Welcome to the Eagle."

And for you Phantom jocks let me tell you the best kept secret that we ex-Phantom jock-now-Eagle drivers have. The Eagle is easier to fly than the Phantom. ★



ABOUT THE AUTHOR

Major Skanchy entered the Air Force in 1962 and took his pilot training at Williams AFB AZ. He spent his first three years instructing in a command other than TAC, and has also served in Korea, Japan and Vietnam flying the F-4 Phantom. He was assigned to the initial F-15 cadre, and is currently operations officer in the highly respected and world famous 555th TFTS "Triple Nickel". Major Skanchy has over 4,000 hours flying time.



engine durability testing

...a lesson learned

CAPTAIN THOMAS A. STEIN, Aeronautical Systems Division, Wright-Patterson AFB OH

Accelerated mission testing, based on actual operational usage, is a valuable tool which can lead to safer, more durable engines.

In the Air Force acquisition/development arena, there is a continuing need to glean lessons learned from our past development experiences and use this knowledge to better accomplish our present and future development tasks. In this regard, aircraft gas turbine engines are receiving greater scrutiny than any other aspect of our new aeronautical systems. This results from a noticeable increase in the incidence of aircraft turbine engine failures and from operational and support costs for recent developments that are much higher than originally anticipated. There are a multitude of reasons, and a thorough discussion of all cause factors is obviously beyond the scope of one article. However, this article will address one of the more significant and universally accepted lessons that is being learned: that *accelerated mission testing*, based on actual operational usage, is a valuable tool which can lead to safer, more durable engines.

This article should be of interest to operators because it discusses (1) the nature of engine durability problems; (2) the impact usage can have on engine durability; and (3) how accelerated mission tests are constructed and used to improve turbine engine safety and durability.

For any engine development program, there is a strong need to devise an engine endurance test which will reveal structural durability problems. These are insidious problems that generally show up only after long term engine operation. Their very nature makes them difficult to uncover. Further, structural durability can involve a number of failure modes. For instance, blades, disks, spacers, shafts, and even cases may be sensitive to metal fatigue

(termed Low Cycle Fatigue—LCF) and fail after a period of successful service. In the engine hot section, turbine blades may be sensitive to the combined effect of sustained stress and temperatures and fail in a creep or stress rupture failure mode.

Blades are also especially sensitive to a vibratory failure mode termed High Cycle Fatigue (HCF). Engine components may also be sensitive to other forms of long-term degradation such as erosion and wear. The point is that engine components are subjected to various, complex, and many times interactive failure modes. This fact makes these long-term durability problems difficult to uncover. Because even the most advanced analytical techniques fall short, a realistic ground endurance test becomes critically important for assuring long-term engine flight safety. It is easy to be misled; the idea is not to over test or under test but to test in such a manner that test inputs and consequently test results will have a close correlation with actual service.

In the propulsion development community within Aeronautical Systems Division (ASD) at Wright-Patterson AFB, a conscious effort has been made to evolve a realistic engine durability test by carefully considering what drives engine durability. This has led to a new approach and a significant departure from the traditional 150 hour qualification test which is arbitrarily defined by specification. This approach is termed *Accelerated Mission Test* (AMT) and is being applied to various engine models within ASD purview. It is proving to be a valuable tool for identifying and preventing engine durability problems. This experience has proven to be a valuable "lesson learned." Further, it has important implications for operational personnel because throttle movement can have a big impact on engine durability.

ENGINE DURABILITY

Many engine components are durability or "life limited." The amount of life capability a part possesses is determined early in an engine design and is a function of operating stress levels, material characteristics, temperature, and design details. However, actual engine usage, specifically throttle movement, determines how rapidly this finite life is consumed.

LOW CYCLE FATIGUE—LCF

Both the frequency of movement and the magnitude are significant for LCF damage. These movements produce changes in centrifugal stress for rotating parts, due to changing spool speeds, and also produce thermal stress, due to changing temperature levels for each part. These stress excursions or stress cycles produce fatigue damage which can result in failure. This concept is best visualized as shown in Figure 1 with the stress range vs cycles, or SN curve. Higher stress excursions result in lower cyclic life. Point A represents a stress level below which infinite cyclic life exists. In reality, very few components are stressed at this low level, hence, most have a finite fatigue life capability. Throttle movement magnitude is not constant, and Figure 2 is provided to show typical relative LCF damage contributed by various throttle movements for particular classes of parts. This assessment is based on a detailed stress analysis of each part and shows that in addition to the O-max-O cycles, idle-mil-idle cycles are damaging. This is particularly true of low spool components in a turbofan and results from the large speed range the low spool experiences. It should be apparent the LCF is particularly a problem for fighter type engines in view of the relatively low life capability (high stress levels for high thrust to weight ratio) and relatively high throttle usage or damage accumulation.

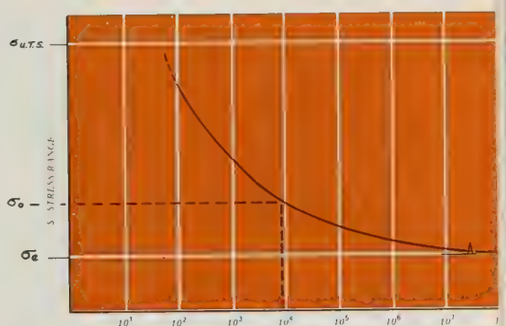


FIGURE 1 TYPICAL SN CURVE

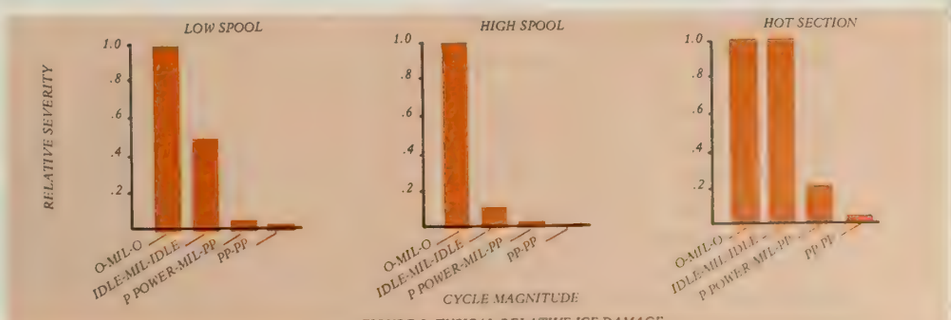


FIGURE 2: TYPICAL RELATIVE ICF DAMAGE

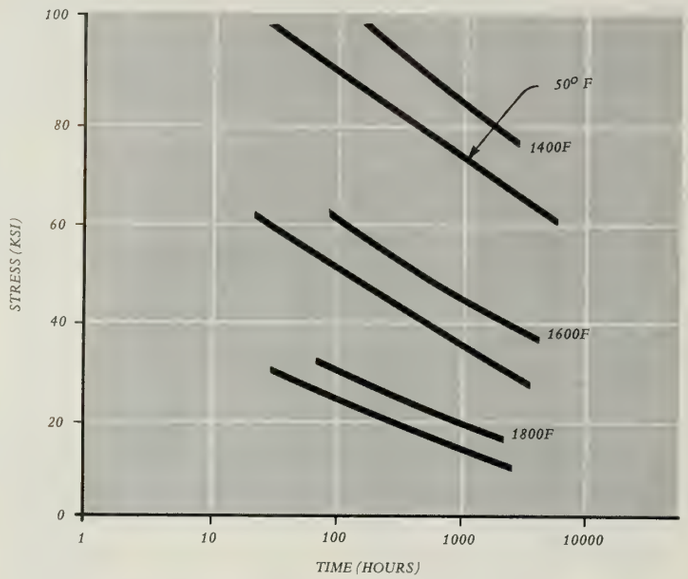


FIGURE 3: EXAMPLE STRESS RUPTURE DATA

STRESS RUPTURE

Time spent at high engine power setting results in sustained stress at high turbine temperature for engine hot section parts. Some parts (principally turbine blades) have a high temperature life which is finite. Figure 3 shows typical stress rupture data plotted against variables of stress, temperature, and time. Time spent above a threshold turbine temperature (generally corresponding to maximum continuous) consumes this finite life. Therefore, operational usage with extended periods of operation at max power also hurts engine durability. It should further be noted that an interactive effect between fatigue (cycles) and temperature effects (hot time) may exist. For instance, a turbine vane may develop cracks in LCF driven by cycles and then erode as a function of hot time. This factor makes it especially important that durability simulation tests contain these effects in the proper proportion.

AMT—TEST SET UP

The following discussion explains how this insight concerning engine durability has been used to develop Accelerated Mission Tests. These programs are uniquely modeled for each engine model and begin with a detailed knowledge of actual engine usage, i.e., how you guys use the throttles. This information is generally obtained through extended visits to field operating locations to discuss flight and ground operation with operational personnel.

Throttle movement in terms of power lever angle (PLA) or per cent rotor speed is characterized against time for all missions within the total mission mix. From these data, a representative flight test cycle is derived which simulates an average flight sortie. Similarly, a representative ground operation test cycle is derived which simulates damage imposed during ground operation, principally test cell and trim pad. These test cycles contain the damaging events, large throttle movements and time at high temperature, as they would occur in service; however, the relative undamaging small throttle movements and time spent at part power are deleted, creating an accelerated test cycle. An example is shown in Figure 4. This is both an economic compromise in view of engine test costs and also allows years of representative damage to be imposed in a relatively short period of test time.

These tests are generally run in a sea level test facility; however, this will depend on service usage. It may be necessary to conduct a portion of the test in a pressure altitude test facility so that stress and temperature effects can be properly duplicated. This is particularly true for high mach number operations. Once test conditions and test cycles are established, representative flight and ground cycles are run in a

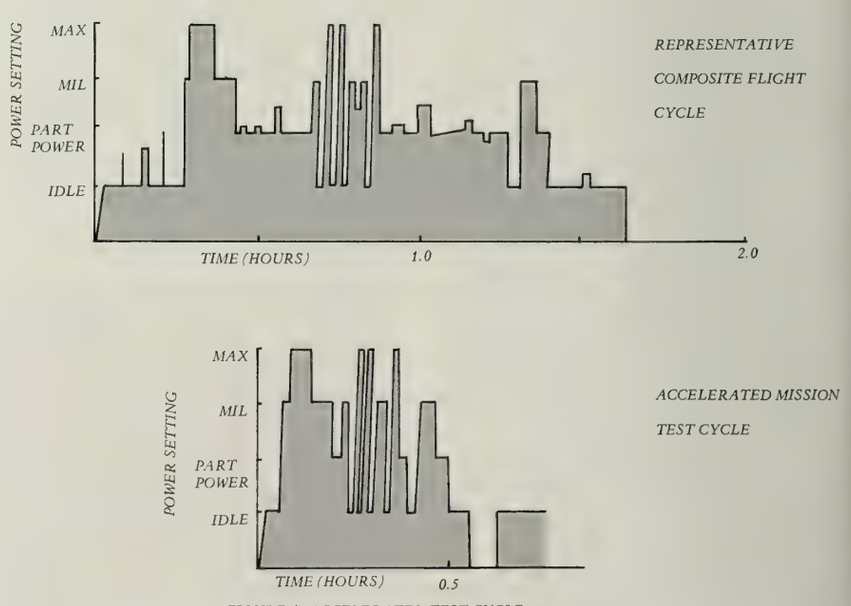


FIGURE 4: ACCELERATED TEST CYCLE

proper sequence such that actual service usage is simulated in test.

It should be evident that the success of this approach is dependent on whether test experience correlates well with actual service experience in terms of type and degree of hardware distress. Experience to date has been very encouraging. Figure 5 summarizes various engine accelerated mission tests being conducted within ASD purview today. Where possible, accelerated mission test engines are torn down for analytical inspection and comparison with *lead the force* service engines at an equivalent service exposure. An example of this correlation is shown in Figure 6.

These turbine vanes were taken from test and service engines at an equivalent number of service hours. These results are indicative of the good correlation between test and service being experienced. In some cases, this type of test has successfully duplicated known service problems that could not be duplicated in years of previous factory test experience. In other cases, durability deficiencies have been uncovered through AMT well in advance of the force so that orderly, timely redesigns can be effected with minimum operational impact. The success of this approach has proved to be a valuable "lesson learned" and provides the development community with an important management tool for identifying problems early and correcting them before they can become serious field problems.

USER—IMPLICATIONS

This "lesson learned" also has important implications for operational personnel who have their hands on the engine throttles. Engine durability and engine usage are keenly tied together. Consequently, the engine development and logistics support communities must understand how our engines are being used. You might note that our most advanced engine developments have unique engine instrumentation for counting cycles and recording time above discrete temperature levels. This information is used for defining and tracking engine usage and will help us do a better job of structural life monitoring. This experience also says that your throttle movements do make a difference. Given a choice, the number of throttle cycles, the magnitude of cycles, and time at high power should be kept to a practical minimum to extend engine structural life.

SUMMARY SPECIFIC ACCELERATED MISSION TESTS

ENGINE	USAGE SURVEY	TEST ARTICLE'S	NOMENCLATURE
TF41	OCT 74 OCT 76	142072 908	SIMULATED ACCELERATED FLIGHT ENDURANCE TEST (SAFE)
J85-21	NOV 74 JUL 76	225L05	LCF ENDURANCE TEST
F100	APR 75 JAN 76	FX207 PX273 PX438 (F-16)	ACCELERATED OPERATIONAL MISSION TEST (AOMT)
TF34	JAN 76	0027 0025 0015	SIMULATED SERVICE TEST (SST)
F101	PROJECTED USAGE	0019	LIFE CYCLE TEST (LCT)

FIGURE 5

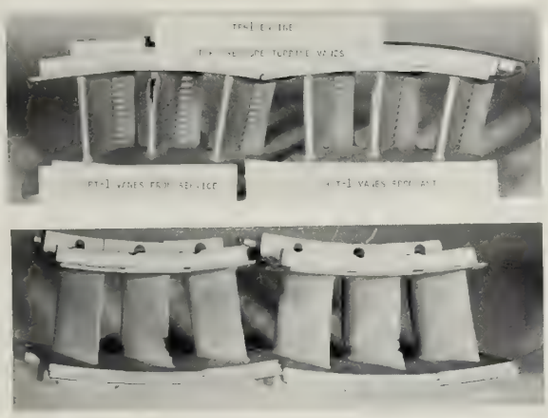


FIGURE 6

AMT—IMPORTANCE

Since equivalent service hours can be accumulated by test in a short period of calendar time, AMT provides a means of looking out into the future and identifying problems before they cause serious safety, economic, and operational impacts. This approach can be used to screen engine designs for their intended service life and provide greater assurance of engine structural integrity. Additionally, the results of AMT can be used to establish more realistic parts reject/overhaul criteria and a more stabilized logistics support environment.

In sum, AMT can improve engine flight safety and can help lower engine operational and support costs. This means less risk of engine failure and better durability characteristics for the operational community. AMT has been written into our advanced regulations and standards governing the engine acquisition process and the concept has become an integral part of our newest development programs. ★

SOME COMMENTS ON....

WIND SHEAR

MAJOR DAVID C. CARTER
132 TFW, Iowa ANG

"Rapid 21, turn left to 330° and intercept the localizer at or above 2600 feet. One mile from the marker, cleared for the ILS approach to Three Zero Right, contact Tower 257.8."

"Rapid 21, roger, cleared for the approach." (You weeney—I'm 6 months from my last bag ride in weather, and you give me a 1-mile turn-on with a 30° intercept. . . . gear, flaps, landing light. Here comes the localizer off the stop; bank left, pitch changes to hold altitude as speed decreases and flaps come down . . . roll out, catch the IAS with power at 170 KIAS, the glide slope is already in the center, lower the nose and pull a bit of power, turn back right for the first cut at wind correction—I'm already a dot left.

Passing 1800 for a DH of 1160. Vertical Velocity is about 700 and holding half a dot low—super! Localizer's going left, dip left wing a moment and level out—localizer is almost still now. Add a bit of power —5 knots slow, there goes the localizer again. There goes the glide slope almost a dot low—gotta stop that—add a tad of power and raise nose a dot. Gadzooks! Near 2 dots low and going fast!

Full power and raise nose 4 degrees. And I'm 10 knots slow. There it comes—one dot low and going to center, lower nose a bit. Now I'm 10 knots fast—back on the power. Dang localizer—forgot to keep it trapped during that glide slope crisis. DH, there's the field, jink right and left, dip a wing and opposite rudder for the crosswind . . . touchdown.

Home free again! . . . rollout . . . clean up the cockpit . . . taxi back. . . . I wonder if the ILS glide slope transmitter fouled up momentarily? I'm sure I had that V/V and glide slope wired. How could I have gone so low so fast? Full dang power and really had to haul the nose up to stop that beauty! Lucky it was me and not some young flack-bait new guy—he would have sunk into the trees for sure. . . . mumble, mumble. . . ."

Voice from nowhere:

"Hey, hero! Yeh, you—the guy taxiing back talking to yourself. You always do that—talk to yourself? What's that? You also read to yourself? *Playboy,* no doubt."

"By chance, did you happen to read *TAC Attack* for Sep, Oct, and Nov 1976? The three-part series on low level wind shear might give clues to the answers to those hard questions you're asking yourself.



Pay attention while reading the articles and remember: If you don't learn something from every flight, you're over the hill."

(Comments overheard in the pilots' lounge two hours later.) Those articles were good—not the pointy head stuff you might expect from a non-flying weatherman or a safety guy playing Halloween spook (trying to scare everyone but not being very realistic). Look at Part I, the last paragraph, where it says, ". . . an aircraft can, in a matter of seconds, descend into a zone where wind direction/speed is substantially different. . . . the pilot may not be able to accelerate or decelerate . . . rapidly enough to prevent a substantial effect on aircraft performance. A successful recovery may range from being physically impossible to highly dependent upon immediate corrective action by the pilot."

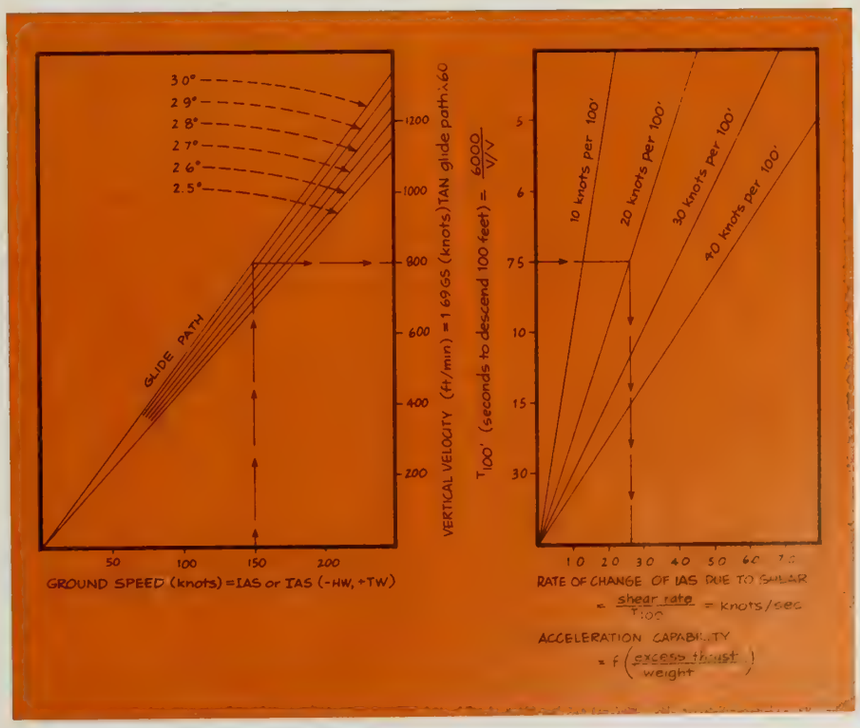
Boy! Does that sound familiar! I hacked it today, but it wasn't hot and I was at normal landing weight and had good acceleration capability. And I was fairly aggressive in correcting. Even so, I still had full scale below the glide path for an instant. Also, the article hit another nail on the head: A pretty good cold front had gone through within the hour. Maybe I did experience the effects of wind shear. On the other hand, my cross-check and reactions were slower than my normal "superior" level. But I find it hard to believe that I got that low all by myself, even if I haven't had as much instrument practice recently as I'd like.

Part II of the series covers in fine detail the specific effects of shear on the aircraft. It is really eye-watering to think of the percentage decrease in lift that a shear can cause. Using an F-100 speed of 170 IAS/TAS and assuming the loss of a 20-knot head wind, I'd lose 22%—1/5th!—of my lift if the speed change occurred instantly.

Some pilots who scanned Part II balked when they came to the sentence on page 19 that said, ". . . the Indicated Air Speed (IAS) will drop instantly by the amount of wind shear." It was worded better in Part I, as quoted just above. But, to defend the author and support the overall excellent effort to help us pilots, the graph below shows in exact terms just how fast the IAS will change. It is true that it doesn't change instantly. If there's a 20-knot shear in 100 feet of descent, and it takes 7-to-10 seconds to descend 100 feet, then IAS changes at 2.8 to 2.0 knots per second, respectively. That's not instantly—but it isn't slow either!

Consider the F-100 on a hot day with full internal and 500 lbs still in each tank on the first practice instrument approach: Before starting down the glide path, if the pilot gets 10 KIAS below the full flap final approach speed he'll have ZERO excess thrust available for acceleration. I've seen two pilots have to lower the nose for a moment (unload and extend right on final approach!), just to regain speed. They

FIGURE 1



only went down 100 feet but the example illustrates how little excess thrust was available on those occasions. Going down the glide path, the power is back about 3%. Now throw in the wind shear: 3% is all that's available to accelerate the aircraft nearly 3-knots per second. That airplane *is* going to slow down or descend or both until enough time has elapsed to slowly accelerate back to steady state flight. During that time the pilot has his hands full.

Is there a situation where the aircraft's IAS will change instantly? I think so. I recall an early morning mission during UPT at Williams AFB. The objective: Practice SFOs. I'd done well on similar sorties previously. The first pattern was looking near perfect and my IP was relaxed—until hard stall buffet and my burst of throttle jarred him into wide-eyed attention. We were still approaching the runway threshold at maybe 30 to 50 feet in the air. "Too far out to be going so slow, dumb student," my instructor's glare and muttering implied. It happened once or twice more. The debriefing later was quick, contained more comments about judgment, and left us both feeling an uneasy discontent.

"Weather" was slated for afternoon academics, and—you guessed it—wind shear was one of the topics. A call to the base weather station later in the day reinforced my suspicions—I had been "had" by shear that morning and neither the IP nor I had recognized it.

Most people who have flown in the desert recall the early morning drives to work: The wind is dead calm, the smoke goes straight up to double or triple the height of a house, then goes horizontally. That's probably as close to an instantaneous shear and change of IAS as you'll find anywhere.

Back to the series in *TAC Attack*. Part III looks at methods of warning pilots that they might encounter shear, then talks about what the pilot can do if so warned. After reading the article, it looks like the only thing presently available to pilots flying non-inertial/doppler nav equipped aircraft is the buddy system: PIREPs. True, there's no current requirement to report shear, and no official doctrine on what to say or who to tell if you wanted to help your buddy coming down the slide behind you.

What would you want to hear from the guy 5 miles ahead who just had a hair-raising experience with shear? I want either the altitude he was passing or the approximate distance from the field or TACAN. Altitude is better for me because of two things: I have a good indicator in the cockpit, and I'll know where the shear is relative to the ground and will be able to judge the threat, i.e., is it going to get me while I'm still IMC, just as I break out and am trying to transition from instruments to visual, or in the flare?

So, fellow aviator, if you experience any of the weird sensations on final approach so well described and explained by Major Carpenter in the three part series, please remember that I might be coming down the slide behind you. Speak up and tell the controller to pass on to succeeding aircraft that (1) you think you encountered (moderate or severe) wind shear at (altitude MSL) which caused you to (sink or balloon), (2) you had (difficulty or no difficulty) coping with it, and (3) you corrected for it by adding some power, or adding full power or coming to idle for a few seconds. ICAO and the weather people may not have the terminology to communicate the true severity of the wind shear, but surely we pilots, who do so many things so much better in so many different ways can come to the rescue of the regulation and procedure writers and show them the way.

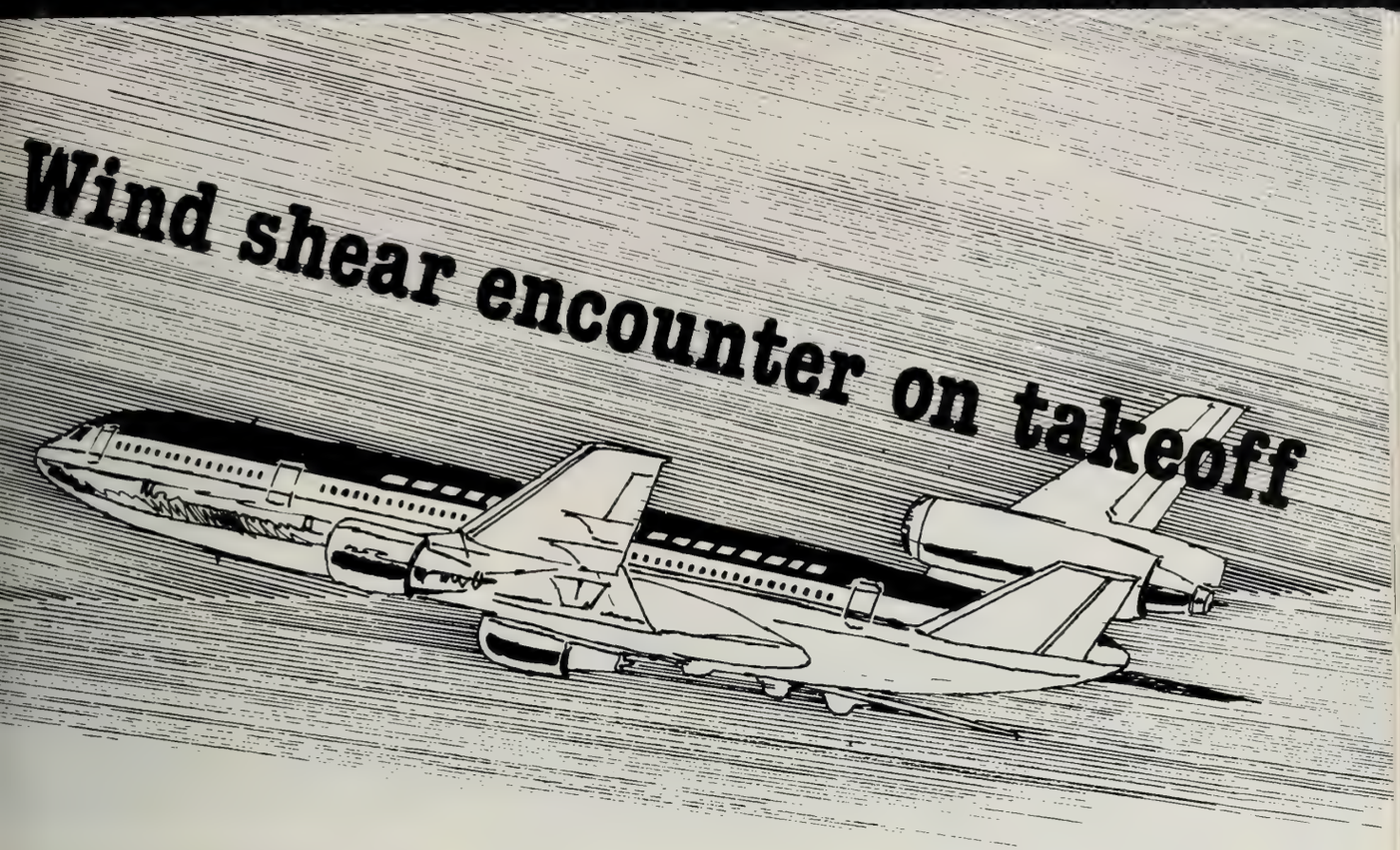
Voice from nowhere:

"You did your homework, Sonny. But don't let all that new knowledge and expanded perception cause you to expect too much from others. That guy down the chute in front of you may not speak up because he may not recognize a shear for any of several reasons. (1) It may be his first experience with shear—all prior lectures and articles may have gone clean over his head. (2) Regardless of his prior experience and book-learning, his present instrument proficiency and weak self-confidence may be such that he'll be kicking himself in the rear instead of analyzing what happened—so he'll fail to look beyond himself for reasons other than personal failure. (3) He may be one of the many pilots with a non-technical college degree who doesn't particularly like math or the 'quantified' or technical approach to flying topics. Hence he will have chosen not to read or study the *TAC Attack* series 'because they are too deep', and he may not recognize the shear or know what to say if he does recognize it.

"On the other hand, if that guy out in front has the drive to be the best pilot in his field, if he has strong survival instincts, or simply feels he's found another way of strengthening his wing or command's flying safety program and preserving its enviable flying safety record, then he will have done his homework and will have (1) gained a perspective on the occurrence of shear and effects of shear on the aircraft, its autopilot, and other automatic/sophisticated equipment and indicators, (2) chosen some visual or instrument clues pertinent to his type aircraft that will alert him to the occurrence of significant shear, and (3) will have planned in advance what he'll tell the Tower or Approach Control if he suspects that he encountered a significant shear."

For a first hand account with "instant shear", see the following article "Wind Shear Encounter On Takeoff." ★

Wind shear encounter on takeoff



During the late afternoon of 4 March 1976, while holding a DC-10 for takeoff on ORD Runway 14L, wind 130-140° at 5-8 knots, ceiling 100 feet RVR 1600 feet landing, 1000 feet rollout; two flights missed their approaches because they were unable to stabilize their airspeed. The tower later advised that there was a wind shear at 500 feet from 240° at 50 knots.

A Pilot Report:

"Just as we became number one for takeoff, two inbound trips pulled up at the middle marker due to severe turbulence. We were then cleared for takeoff. At 300 feet I began to increase my airspeed to 180 knots, 40 knots above V_2 expecting turbulence and wind shear. As we went through 500 feet on climb, our airspeed dropped instantly to 135 knots, a 45 knot decrease with heavy turbulence. The nose was lowered to level flight and it was quite some time before we regained V_2, and even more time before we could climb.

The point of this is that even though I was expecting a drop in airspeed I was shocked to see it drop so fast for so long. Had I been climbing at V_2 +10 knots in this condition, lowering the nose to level flight would not have been sufficient to keep from stalling, and there was not enough altitude to swap for airspeed. I have flown through wind shear many times but I have never seen so great a change over such a short vertical distance. I am sure glad that I was expecting it."

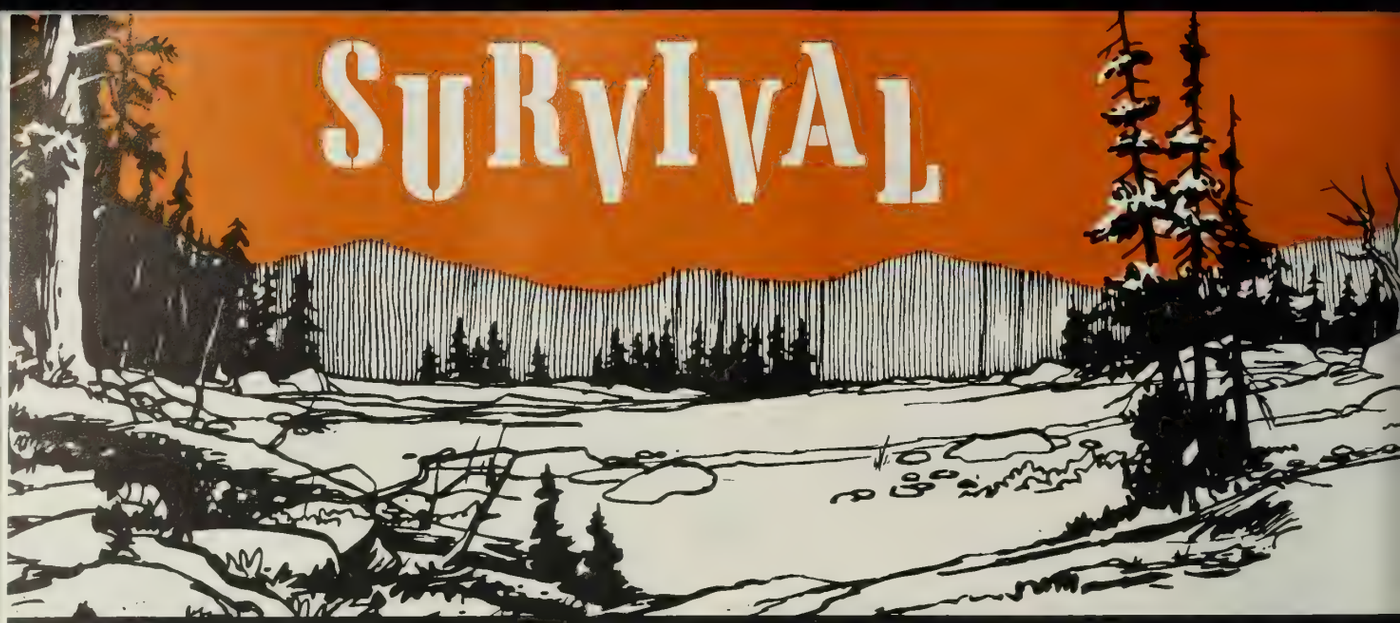
The Weather Service was checked for a more detailed account of the weather picture at the time of the incident, and this description was obtained:

"The weather situation between 1800 and 1900 CST at ORD on 4 March 1976 indicates two types of low level wind shear. One type associated with a warm front and the other associated with thunderstorms to the northwest of the airport.

"A warm front extended from Burlington, Iowa, to just south of MDW. Surface winds in the cool air to the north of the front at ORD were south easterly at 5-8 knots, and the winds in the warm air aloft were from the southwest at 50-60 knots. The temperature difference across the front at the surface was approximately 20°. The normal slope for a warm front would have placed the wind shift line at about 400-500 feet about the surface in the ORD area with sharp wind shear.

"A northeast-southwest line of thunderstorms was located about 30 miles to the northwest of the airport. A gust front with the thunderstorms was indicated by the surface wind when they passed over O'Hare Field. The nose of this gust front aloft could have protruded ahead of the surface position by as much as two or three miles."

—Courtesy *The Grapevine.* ★



Take Cover, Men!!!

SGT HERBERT A. KUEKER
Programs and Current
Operations Branch
3636th Combat Crew
Training Wing
Fairchild AFB WA

Ever since man carried stone axes, there have been people on this globe who spent their entire lives wandering around in search of food. They have lived in a variety of housing, from caves to animal hide tents. Being transients, these people are never bothered, or concerned for that matter, with constructing a nice home equipped with swimming pool, rose garden or sauna. After all, not even Hollywood types would build a beautiful castle and then only sleep there one night. But, just as the need for temporary shelter is evident to "primitive" peoples, so should it be of concern to a downed aircrew member. Let us talk briefly about the need for temporary shelter, what it should consist of, and how to go about making or finding it.

Even though primitive man does not build mansions, he always keeps some basic principles in mind when looking for shelter: It should be near food and water, be easy to build, provide protection from the elements, and still be comfortable for all of the functions that will take place there.

If your bird ever lets you down and you're going to be on the ground overnight, you should remember those basics. Always prepare your shelter as soon as practible, because you cannot predict hostile weather conditions and you won't really know when you will be rescued. If possible, attempt to find a homesite near water, food, your signaling area, and usable shelter



construction materials. Now that does not necessarily mean that you should build a nine pole teepee next to a stream that runs through an open meadow. Why? Because there may be a cave or some other type of natural shelter only 100 yards away. Anyone who has ever built a teepee out of parachute materials and poles can testify that it is a whole lot easier to move into a cave! At any rate, you *need* some type of shelter. Even on a mild summer night, the dew can soak you to the bone. Just imagine what a snowstorm or driving rain can do for your health and morale!

Well, if not a nine pole teepee, what *do* you need? First, you need something large enough for you and your equipment, something that will keep you dry, out of the wind, and allow you to rest. Everything you construct in addition to that is a luxury, such as using bark for a waterproof shingle effect on your roof, building a fireplace out in front of your shelter, bough beds, etc.

Any materials or location which can provide protection for you and your equipment should be used. For example, you can find shelter under

rock overhangs, under heavy brush or tree limbs, inside natural caves, or maybe even in a culvert which runs underneath a road. It may seem tough, but the truly ingenious survivor will incorporate parts of a wrecked aircraft, his parachute, a space blanket, and some tree branches or anything else into a waterproof abode. The trick is maximum utilization of your environment. Just because it is out of the ordinary does not mean you cannot use it.

If you should have to move, always keep your eyes open for usable shelter areas. Immediate encampment may become necessary for a variety of reasons, such as the onset of nightfall, fatigue, weather, etc.

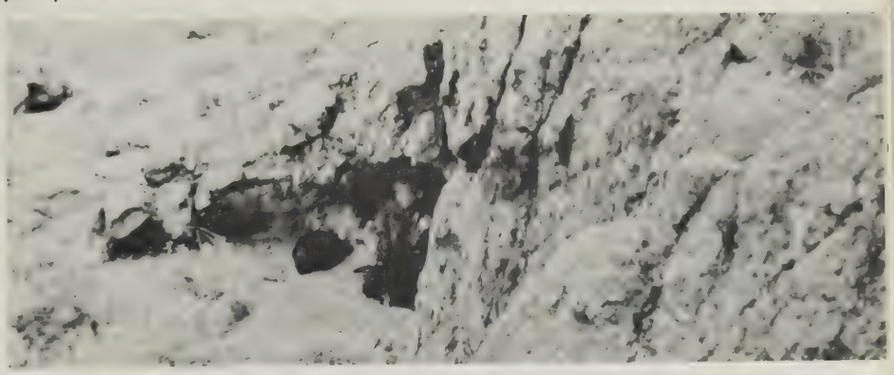
So, what have we said? Basically, that when you are a survivor, you, like primitive man, are transient, which means that you do not need a permanent home. Also, that no matter where you are, you *do* need some sort of shelter to protect you from the elements and bolster your morale, if you have to remain overnight. Obviously, your shelter has to be large enough to accommodate you and your equipment. And, finally, that you should use any natural formations or existing materials for the construction of your temporary home.

Keep in mind that primitive people have seen a need for shelter each and every night for millions of years, and they "still have not been rescued." So, as a survivor, you have to adapt to their ways and find shelter, whether it is for 6 hours or 6 days. The object of the whole thing is not just to look cool when the "white hats" come galloping over the ridge. You might make it without shelter, but you will be far better off warm and dry than cold, wet and miserable.

Questions or comments concerning the information contained in this article should be directed to 3636 CCTW/DOO, Fairchild AFB WA 99011, AUTOVON 352-5470. ★



When possible, survivor should try to locate shelter near water and food source. Cave, as in photo below, could make ideal shelter. Poles and parachute material can make a good teepee. Or, other natural materials can replace parachute cloth as in bottom photo.







THE IFC APPROACH

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

REVISED AFM 51-37, INSTRUMENT FLYING

The revised AFM 51-37 is now in distribution. If you've had a chance to look at the manual, you probably noticed that it has been completely revamped from cover to cover. While it is not within the scope of this article to cover all the changes, some of the more significant areas should be addressed in the hope that it will stimulate you to look closer at what we believe to be a manual vastly improved over the previous edition.

The first thing apparent to anyone familiar with the present manual is the complete change in format. The new manual has only seven chapters, as compared to eighteen in the old edition. This reduction was accomplished primarily by reorganization and the removal of outdated and unnecessary subject matter, such as radio range and the history of instrument flight.

The revised edition begins with general information about aircraft equipment and instrument flying in the first two chapters. The remaining chapters are organized sequentially from preflight through final landing, with the last chapter being devoted to supplemental information. A quick glance at the chapter titles below will more graphically illustrate the new format of the manual.

Chapter 1 Aircraft Equipment
Chapter 2 Basic Instrument Flying
Chapter 3 Preflight
Chapter 4 Departure
Chapter 5 Enroute
Chapter 6 Arrival
Chapter 7 Additional Information

For standardization and ease of reference, each paragraph has been numbered similar to Air Force regulations such as 60-16.

Along with the overall streamlining of the manual, a number of procedural changes have been made. Some of the significant changes are listed below:

1. The maximum teardrop angle for holding pattern entry has been increased from 30° to 45°. The resulting greater displacement from the holding course will allow fast movers, that have a large turn radius, a better likelihood of an inbound course interception without overshooting. The teardrop entry zone depicted on the upper right corner of high altitude approach procedures will continue to reflect 30° offsets. Pilots desiring to use 45° should consider other means of determining when they are conveniently aligned.

2. When performing a circling approach, either a left or right base turn is permissible unless restricted by the controller, the instrument approach procedure, or the Enroute IFR Supplement.

3. The tolerance for determining "on course" during descent has been changed. A pilot may now begin descent when within, and will remain within, 2½° of the desired course.

4. Pilots may now begin descent from a low altitude Initial Approach Fix (IAF) when abeam or past the IAF and on a parallel or intercept heading to the published course or arc. This new procedure standardizes descents from both high and low altitude IAFs.

5. Outbound timing for holding patterns, procedure turns, and holding patterns (in lieu of procedure turns) has been standardized. In all cases, timing is begun when abeam or over the fix, outbound. If this position cannot be determined, such as with some ADF equipment, then begin timing when wings level, outbound.

6. Pilot and controller responsibilities for obstacle clearance have been expanded. The manual contains a discussion of minimum vectoring altitudes used by radar controllers, and pilot responsibility for maintaining position orientation while being radar vectored.

7. Additional guidance has been added to ILS glide slope deviations. If you exceed half scale below glide slope or full scale above glide slope, do not descend below localizer only minimums. However, if the aircraft can be repositioned within these tolerances, you may continue the approach to published ILS minimums.

AMF 51-37 is no longer a required publication for all pilots. Commanders are authorized to determine their unit's requirements. However, sufficient copies should be maintained in each unit to ensure availability to all aircrew members.

Although smaller in overall size, many topics have been expanded and clarified to reduce confusion that has existed in the past. Additionally, wherever regulations and protected airspace allow, we have tried to give the pilot more latitude in his operations. Examples of this can be found in the areas of circling approaches and descent procedures associated with low altitude IAFs.

We feel that the new AFM 51-37 is a vast improvement over the last edition, but only constant updating will maintain its quality. If you have any questions or comments on how to improve or clarify AFM 51-37, call us at AUTOVON 487-4276/4884. We're waiting to hear from you. ★

THUNDERSTORM AVOIDANCE IN TERMINAL AREAS



The preliminary findings of a special project group convened by the National Transportation Safety Board (NTSB) to determine the reasons for the increase in thunderstorm and wind shear related accidents have been made public.

NTSB figures indicate that between 1964 and 1967 there was one terminal area thunderstorm air carrier accident; in 1968-1971 there was also one accident. But during the years 1972-1975 there were eight accidents and 251 fatalities.

The group's preliminary findings included comments in the area of airline management, thunderstorm forecasting and dissemination, pilot training, pilot human factors and wind shear determination.

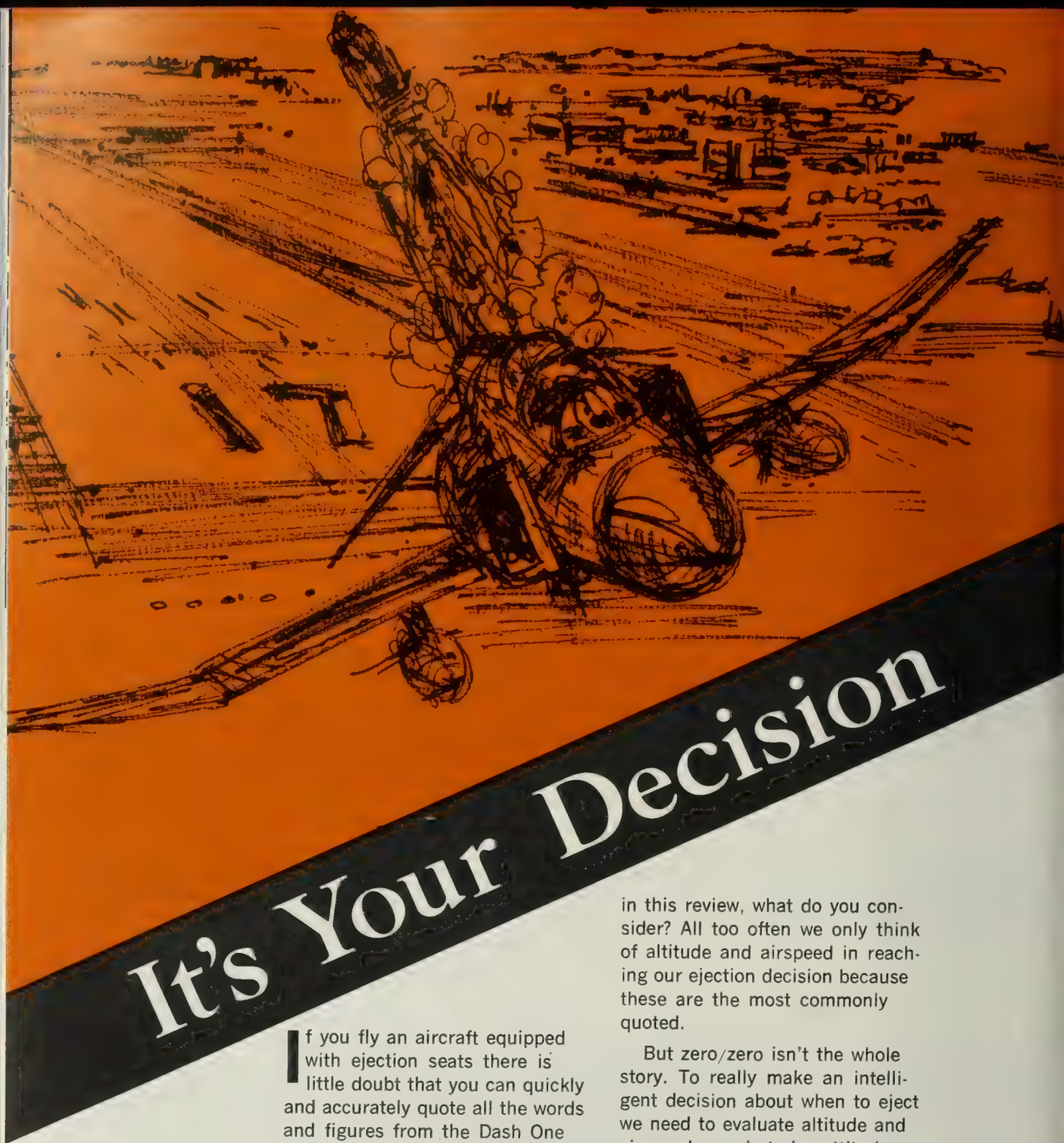
The study indicated that although airline managements have created an atmosphere of safety by supporting pilots' decisions and not exerting pressure on the pilot to "get it on the ground" regardless of terminal conditions, they have not positively told the pilot to "wait it out" in cases of terminal thunderstorm activity. The group found that policy statements concerning thunderstorm avoidance in the terminal area are insufficient in the majority of the air carriers questioned. An NTSB official commented that air carriers need to make a strong statement regarding go-around when unstable flight conditions are encountered below 400 feet. The group also found that training material concerning en route thunderstorm avoidance was excellent but information relative to terminal area thunderstorm activity was sketchy.

It was observed that the factors that motivate pilots to continue flight into a thunderstorm are self induced. The group found that peer pressure was non-existent and that competitiveness did not appear to be a factor in the pilots' decisions.

The study indicated that pilots' estimation of the situation and judgment, rely upon other pilot reports and information furnished by the controller. The pilot needs current information about wind, pressure changes, temperature and storm proximity, movement and intensity.—Courtesy NTSB Special Project Group Preliminary Findings ★



Hawaii Air National Guard F-102A and F-4C fighter interceptors. The delta winged F-102, commonly known as the "Deuce," was retired last October and replaced by the F-4C Phantom. Hawaii's Dueces were the last to fly as interceptors, although some will serve as drone targets.



It's Your Decision

If you fly an aircraft equipped with ejection seats there is little doubt that you can quickly and accurately quote all the words and figures from the Dash One about ejection procedures and altitudes. You know about that warning that says "do not delay ejection below 2000 feet in futile attempts to start engines" and the part that warns ". . . there is a progressive decrease in successful ejections below 2000 feet." You have also reviewed your personal ejection parameters. But, in this review, what do you consider? All too often we only think of altitude and airspeed in reaching our ejection decision because these are the most commonly quoted.

But zero/zero isn't the whole story. To really make an intelligent decision about when to eject we need to evaluate altitude and airspeed, yes, but also attitude, bank angle, and sink rate play an important part. It is the consideration of all these parameters that is most important in a low altitude ejection situation.

Let's take a hypothetical case. Shorty after the gear comes up on takeoff, you feel a couple of thumps. When you glance at the

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety

engine instruments, you see both engines unwinding (or the engine for you single-engine jocks). In either case, you are now riding in a less than perfect glider —so, what do you do?

You first go through the Dash One bold print emergency procedures. If you are lucky, the engine(s) start and you recover with little difficulty, and a good war story. But suppose they don't start? The alternatives are crash landing or ejection.

In most cases, ejection is preferable to a crash landing. The ejection seats in most modern aircraft have the capability to provide safe egress in almost any situation. The problem is that these seats are so good that we, the aircrews, sometimes press our capabilities too far. We ask for more than the seat can deliver.

Although the important part of ejection is in the bold print procedures, to get the most out of our equipment we need to understand a little about ballistics and vector analysis. The best way is to take our hypothetical case and look at the parameters we mentioned earlier and how they can affect your ejection decision.

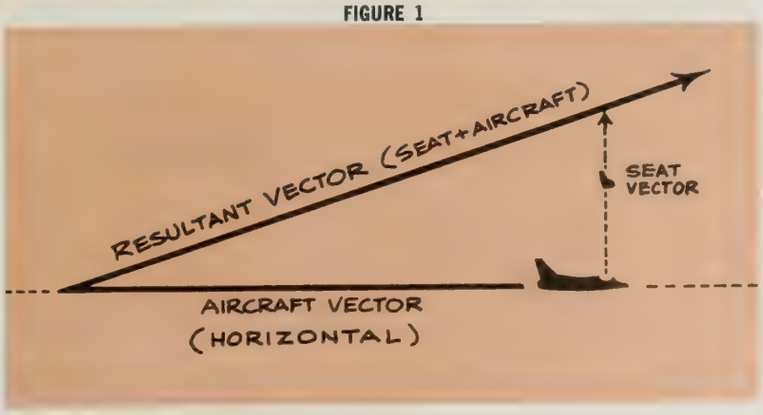
You may have considered the possibility of a flameout on takeoff and decided that just as soon as that engine starts to unwind you're getting out. Well, that is a decision no one with any knowledge of jet aircraft could fault. But if you merely let go and grab for the handles, you may not be giving yourself the best chance. Although you are almost certainly within the ejection envelope when the flameout occurs, you may be close to the edge. Most modern seats have at least a zero feet and 120 knot capability. But in this case we have more than 120 KIAS, and a few feet above zero. Obviously, this is better, but it can be improved further by trading airspeed for up vector. Notice I didn't say altitude. While altitude can give a cushion, the idea of zooming for altitude has an inherent trap we'll discuss later.

Now let's get back to why it's worth taking those few extra seconds to establish an up vector. First, that zero and 120 seat capability means that if everything works perfectly you'll make it. That's a big if. Any delay at all in seat separation, chute deployment or whatever and your chances nosedive. So let's increase the odds in our favor by using knowledge of vectors. A vector is the path traveled by an object having both speed and direction. In an ejection there are two main components which make up the vector of the seat once it leaves the aircraft. These are the seat vector and the aircraft vector. Figure 1 demonstrates this graphically.

It doesn't take a PhD in physics to see that if we change either component the resultant vector changes. Under controlled ejection above 2000 feet AGL there isn't much problem since there is ample time for chute deployment. But down at low altitude, things happen quickly. The secret to successful chute deployment is time. And, since the human body falls at a finite terminal velocity of 200 feet/sec, we can increase the time till ground impact by increasing the resultant vector of the seat after ejection.

To increase the resultant vector all we need to do is increase one component (holding the other constant). Since it is not possible for the pilot to change the boost of the seat, we must work with the aircraft vector. The two components of the vector are direction and speed. If we increase speed, we have more velocity at seat separation. The trouble is, with no thrust from the engines, the only way to increase speed is to dive. At low altitude this is not the wisest course. The other component, direction, is just what we are looking for. A slight change in direction can make a significant change in the resultant.

FIGURE 1



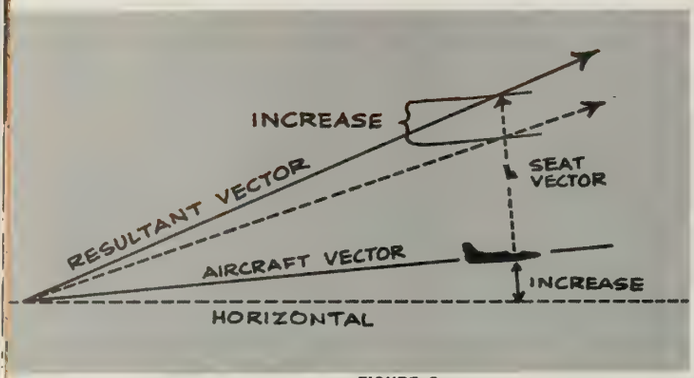


FIGURE 2

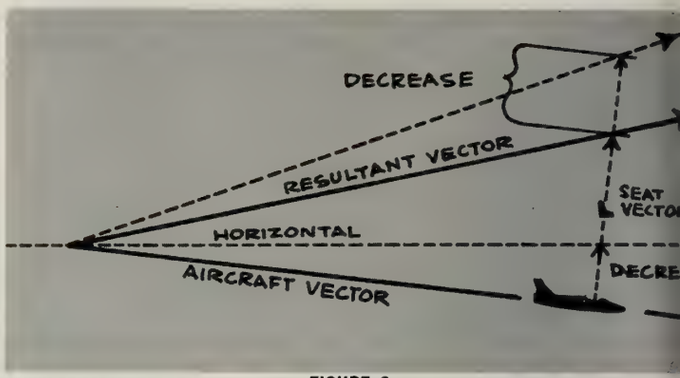


FIGURE 3

This is all very nice and if you can do it, the climb will help give you a cushion for safe ejection. But, just as a climb can help, a descent hurts in an ejection situation. Looking at Figure 2, if we change that slight climb to a descent, there is a dramatic decrease in the final seat vector.

Adding to the problem is the fact that the seat trajectory is the same in relation to the aircraft regardless of altitude, attitude or angle of bank.

To give these facts some reality let's look at the capability of the F-4 seat as a typical example. Figure 3-5 in the F-4 Dash One shows a graph of minimum altitude required vs aircraft sink rate. For a sink rate of 1000 feet/min and 5 seconds reaction time for the pilot, the minimum ejection altitude is 100 feet. No sweat, right? Look at the other criteria: Aircraft speed 135-160 knots in LEVEL FLIGHT ATTITUDE. If we add a 15 degree dive even allowing only 2 seconds crew reaction time, the minimum altitude jumps up toward 500 feet.

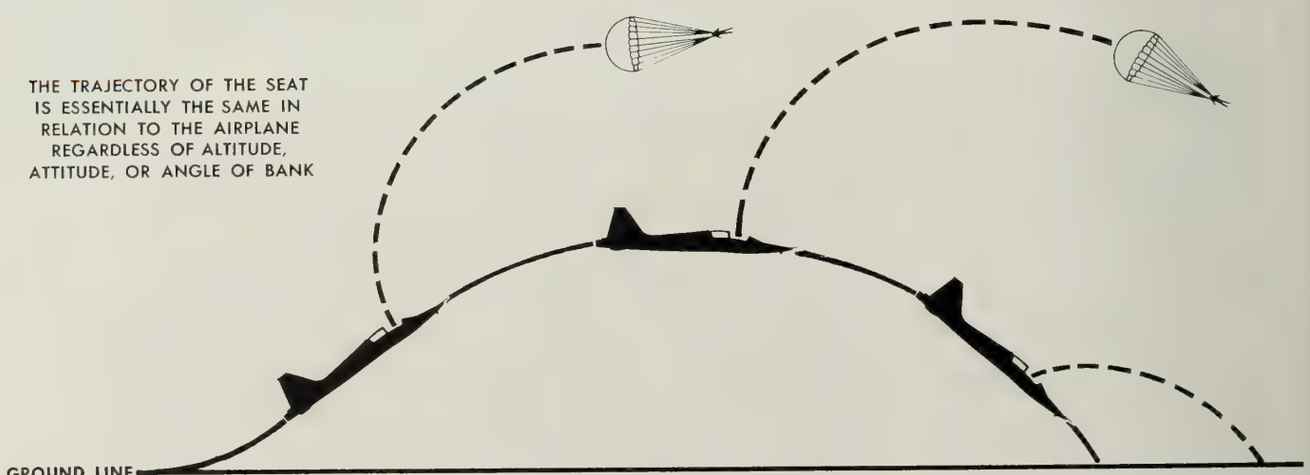
The other factor which hurts us in an ejection situation is bank angle. This isn't as bad immediately as dive is. For example, Northrop states that, for the T-38 seat, a 30 degree bank only reduces the ejection seat travel peak by 14%*. Once past 30 degrees, however, things get worse rapidly. Figure 4 shows the effect of up to 90 degrees of bank.

*Talon Service News, Dec. 1967

By now we can assume you're convinced not to eject in a dive or sink rate (if possible). But you aren't home free just because you point the nose up and climb for altitude. Remember a vector has two components—direction and **speed**. Obviously, speed hurts going down but it can also hurt, or the lack of it, going up. If, when the fire goes out, you pull back and climb for maximum altitude before ejecting, you are also bleeding airspeed rapidly. Anything released with an initial upward vector must reach zero vertical velocity before it starts to fall. The distance you travel is directly dependent on your

FIGURE 4

THE TRAJECTORY OF THE SEAT IS ESSENTIALLY THE SAME IN RELATION TO THE AIRPLANE REGARDLESS OF ALTITUDE, ATTITUDE, OR ANGLE OF BANK



acceleration times the time of acceleration and initial velocity. While modern ejection seats consider gravity effect in their boost parameters, once a sink rate develops this must be subtracted from the seat vector.

While it is true that you are better off with more altitude and, in most cases, optimum ejection (low altitude) is the maximum altitude you can attain, this point is a tricky one. If you delay too long you are past this optimum and into a sink rate and a much worse situation than if you had ejected slightly prior to maximum altitude.

Another concern is that the time required to get a full chute varies with airspeed. For the F-4 this time can be anywhere from 3.5 seconds at high speed to 6.5 seconds at zero airspeed. It would seem, therefore, that the difference of 100 feet or so may not be worth the loss of airspeed necessary to get it. For an F-4 let's assume an ejection at zero airspeed. The seat can give an average boost of 120'/sec. So, dividing by 32'/second for gravity, the result is a time-to-zero velocity of 3.75 seconds. This also will give an apogee of 305'.

From 305 feet, the body of the pilot will begin to free fall, accelerating at 32 ft/sec/second until terminal velocity of 200'/second. For the purpose of our discussion there remains 2.75 seconds until full chute. In this time the pilot will fall about 64 feet. This means full chute at about 240'. No problem if you are level and reach full height. But as we mentioned earlier, any bank or dive reduces the apogee —in a dive you can actually get a chute at a lower altitude than at ejection.

Now that we have all these nice facts and figures, what does it mean for our pilot? Obviously, right after takeoff he doesn't have a lot of extra airspeed or altitude. But he does have enough to establish an up vector and improve his situation. The choice of immediate ejection was discussed earlier. The one thing to avoid is delaying the ejection until airspeed bleeds off and a sink rate develops. Once that happens there is no slack left. Everything must work perfectly if you are to have any chance of survival.

One other point. Low altitude doesn't necessarily mean 100 feet AGL. You should consider yourself in a low altitude ejection situation anytime you are below the altitudes for controlled or uncontrolled ejection listed in your Dash One. In a low altitude ejection situation, the most important factor is time. You need every second to give yourself the best possible chance.

The choices are yours. We are not trying to give you a panacea. Even in our hypothetical flameout there is no one correct answer. The entire situation has to be considered. The point of this whole discussion is this: Although Air Force aircraft are equipped with excellent escape systems, out-of-the-envelope ejections are still the leading cause for unsuccessful ejection fatalities. The decision is yours. You, the pilot, are the only one who can make it. Think about your decision before it's too late. ★

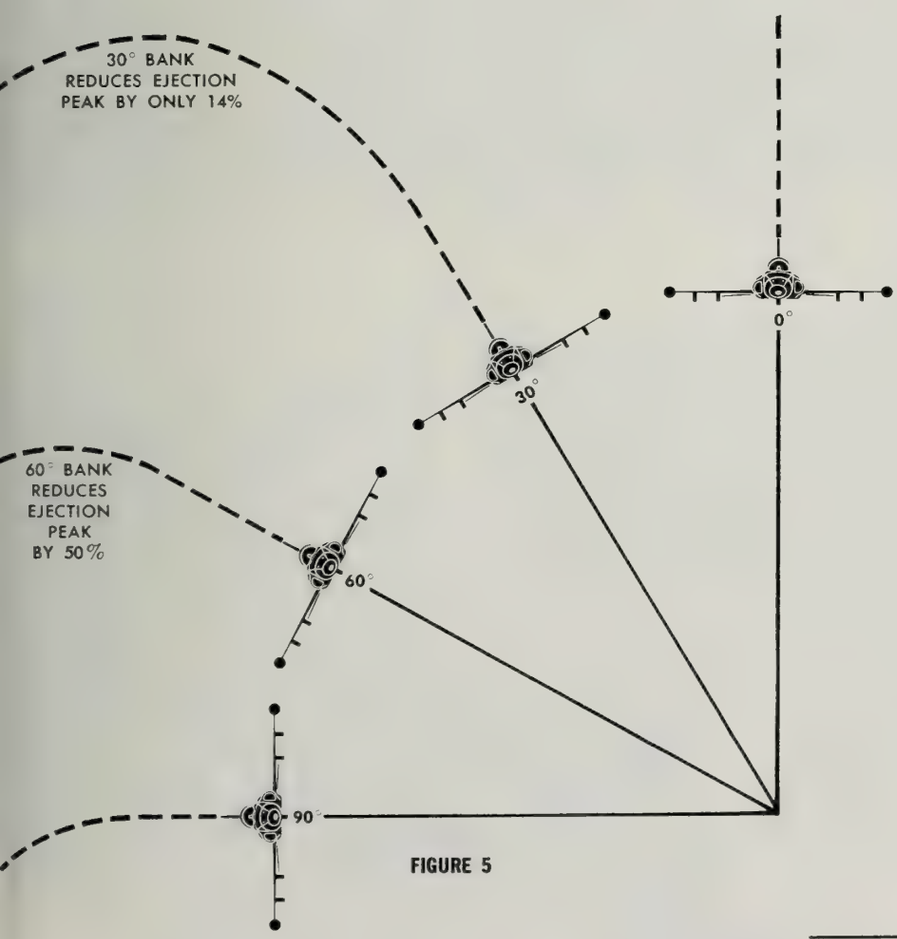


FIGURE 5

A DIFFERENT SIMULATOR

SGT. ROBERT M. CONNELL, JR.
48 AMS, Luke AFB AZ

Sim 18, a multi-million dollar weapons system training set, is a unique mission simulator in the United States Air Force inventory. In the beginning, Number 18 was a standard F-4E mission simulator exactly like the others stationed in various areas throughout the world. During shipment in Europe, an accident involving the tractor trailer rig in which part of the simulator was being transported resulted in fire damaging the equipment extensively. The US Air Force decided that, instead of junking a 1.7 million dollar machine, it could be refurbished with some up-to-date adaptations and return to the inventory as a research and development tool.

The refurbishing was accomplished by a contract awarded to Singer's Simulation Products Division and included the following additions to the basic weapons systems training set: 1. A visual system incorporating a model board for air-to-ground work. 2. A 48" stroke, 6 degree freedom of motion system. 3. Pneumatically operated G seat/G suit system. Later a digital radar landmass simulator (DRLMS) was added.

Sometime during the refurbishing, Number 18 came to be known as "Old Smokey" by those associated with the project. If one were to come to the Advanced Training Devices Branch at Luke AFB, he would see pictures of Smokey the Bear in a few places even today. It's almost like a mascot without the mess!

"Old Smokey" arrived at Luke in February 1975 minus the DRLMS. The simulator was assembled by Singer who had also been awarded the maintenance contract. Acceptance test procedures were completed by the Air Force in July 1975. With the addition of a Halon fire suppression system in January 1976 and DRLMS in April 1976, we have the completed mission simulator as it stands today.

As we enter the enclosed simulator area, the first area of interest is the operator's console. Here the console operator controls various effects on the mission ranging from environmental to radar jamming. A range of malfunctions may be used in training emergency procedures while the instructor may sit down at the console and monitor the pilot's and WSO's actions through repeater instruments and systems status indicators.

For monitoring of landmass runs, the console also contains a radarscope and associated controls with indicators for all weapons' status and modes. All communications and navigation capabilities are also simulated. G seat, G suit, motion and visual systems controls incorporated into the standard F-4E simulator operator's consoles allow operator manipulation of these systems. Air targets, capable of jamming, may also be inserted; however, they do not produce a visual image. The air targets do show up on radar and when the parameters are correct, may be shot down with any of the usual air-to-air weapons which are loaded on the "aircraft" from the operator's console. One would conclude, therefore, that F-4E Number 18's air-to-air capability would be limited to basic air combat maneuvers.

Air-to-ground capabilities are much broader as an 11 x 4 mile area of terrain is simulated with a model board which provides visual targets for a pilot to bomb. By selecting one of the model board targets from the facility control panel on the operator's console and then inserting it as the target to be bombed, a crew may practice dive bombing this target. After impact of the bombs, which does not show on visual, a "score" is automatically printed on the Situation Display indicator (SDI) telling release parameters, distance from and clock position from the target where the bombs fell. This feature assists in training, as on the next run the pilot can know the results of his last run and adjust the pipper/target relationship for a better score.

Another interesting console function is Tactics Test Number 45. Initiating this again incorporates the SDI, except now vectors are displayed showing glideslope and centerline from which an operator

A DIFFERENT SIMULATOR

continued

can talk a pilot down by Ground Control Approach (GCA). This feature is common to all F-4E sims; however, when you as an operator take the visibility down to 500' and lower the cloud base to 200' AGL on the visual display which the pilot observes, things become a lot more interesting. No pilot wants to miss the runway, even in the simulator!

Upon entering the high bay area, one immediately notices the incredible size of the motion base with its six legs looking somewhat like an injured insect. On top of the motion platform are the cockpit and visual head assemblies where the actual benefit of simulation takes place. Located directly behind the motion platform is a service platform with a stairway for access to the motion platform. Underneath the motion platform is a maze of hydraulic, water, air, and electrical lines which drive the motion platform and basically, make the system work.

The water lines cause concern at first because water lines running in the middle of all that electrical equipment doesn't seem quite right, but it's said that the distilled water that runs through them has extremely low conductivity to electricity. The water is necessary to cool the 12 deflection amplifiers contained in the visual head as they use large amounts of current to display the visual images on the six cathode ray tubes (CRTs), also contained in the visual head assembly.

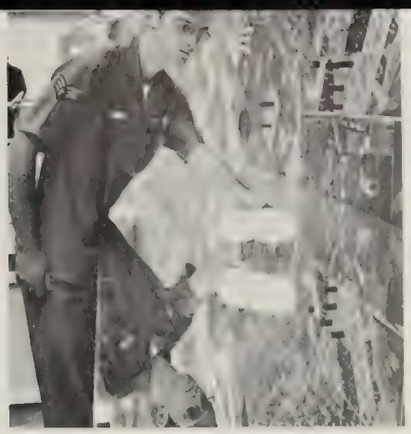
The high visibility yellow platform in front of the motion platform is a maintenance aid for getting to the components in the visual head. Also down on the floor is a water softener for the four air conditioners which cool the simulator's enclosure. Along the walls, the various sized spheres are containers of Halon gas which is a colorless, odorless, tasteless gas used for fire suppression. The fittings connected to the spheres are for distribution of the Halon gas. In the event of fire, sensors strategically placed throughout the simulator would detect the ionization and smoke from the fire, alert the master control box, and, if the condition warrants, "dump" the Halon gas. At this time the fire would immediately be defeated and the gas would dissipate leaving no fire and no residue. All things taken into account, the Halon fire suppression system is pretty nifty. The gas doesn't even affect humans as long as exposure time is kept to a minimum.

Ascending the stairs of the service platform and passing through the gate at the rear of the motion base brings us to the cockpit assembly. The pilot's canopy has an extra hinge facilitating easier access to the front seat as the visual head would be in the way otherwise. The switches and indicators in both front and rear seats are set up like the cockpit of an F-4E and all systems are simulated, hence, a mission simulator. Also a part of the front seat itself are 31 individually controlled air bladders which, inflated and deflated by the computer, provide certain sensations such as sustained acceleration and bank. These physical cues are necessary to back up the cues from the visual display and the initial cues produced by the motion base.

To provide for sustained positive and negative G cues, a G suit is operated pneumatically by the computer. G suit pressure per G and pilot weight for the G seat are controllable from the operator's console. Contained within the visual head, the six CRTs mentioned earlier actually face straight down. Beam splitters and mirrors bend and shape the combined display of the tubes so that the pilot's head becomes the focal point of the display, which is 120 degrees in the horizontal and 60 degrees in the vertical. The pilot's seat can be adjusted; no visual cues are provided for the WSO.

Once the crew is strapped into the cockpit and certain other interlocks are made, the device is ready for operation. When the "motion on" button is depressed, the service platform lowers to ground level and the motion base erects to half the complete extension of the





six legs, or about 2 feet. This is the neutral position and from here the motion base is free to move in six different degrees: pitch, roll, yaw, straight up or down, longitudinally and laterally. If you like to do spin recoveries, we have motion sickness bags on hand!

Next stop is the model room. The three main features of the model room are the model board, gantry assembly, and the light bank. The model board covers an 11x4 mile area of simulated tactical targets such as factories, train yards a city, rural areas and natural looking terrain, including conventional and nuclear bombing ranges. Luke's runways are also on the board; however, they are not staggered as in the real world due to lack of space. TACAN and INS are aligned to the end of the runways making it possible to practice TACAN approaches and touch and goes.

Mirrors surround the model board to give it an endless look when viewed through the camera, so a pilot doesn't get the impression of flying off the end of the world when flying off the board. Cotton placed on these mirrors simulates clouds which look very realistic when viewed through the camera. As you fly off the model board, synthetic terrain generation (STG) provides a display of mile-square areas of different colors that vary in apparent size, depending on your altitude. A gray horizon and blue sky are also generated. This combined display provides a good ground reference for VFR maneuvering.

The gantry assembly holds the camera with a fisheye lens to simulate flying around within the model board area. The fisheye lens is servo controlled to roll, pitch, or yaw corresponding to aircraft movements. The extension from the gantry on which the camera and lens is mounted moves in and out from the model board to simulate altitude changes. The gantry's up and down, left or right movements provide simulation of aircraft movements within the board's area. The gantry assembly is capable of moving a maximum of 6 inches per second which translates to 550 knots as viewed from the cockpit. The light bank consists of 88 one thousand watt mercury lamps. With fill in lighting on the gantry, shadowing is kept to a minimum for daytime simulation. Twilight simulation is achieved by lighting every other lamp, and night flight is simulated by turning all lamps off. The model board is illuminated for nighttime simulation by fiber optics inserted from the back of the model board. By matching the color of the light sources with points to be illuminated, taxiways, threshold, and other pertinent night lighting may be accurately simulated.

Moving right along to the computer room brings us to the source of all of the systems' "brains." One GP-4B drum type computer is responsible for making the simulator fly and controlling all functions except production of the landmass picture. The other cabinets in the room, with the exception of the DRLMS cabinets, are power supplies and linkage between the GP-4B and other simulator systems.

The digital radar landmass simulator has its own computers which are two Raytheon 704 digital processors. Instead of having a landmass plate as the analog landmass does, DRLMS stores all the information for a 1250 mile square on a disc as magnetic spots. The processors take this information and through a very elaborate process produce a landmass return for the radar scopes, just as if we were flying over the terrain in an actual F-4E aircraft. As a matter of fact, our simulated picture is too good, as compared to the airplane, so we had to add noise to garbage it up a bit. If a certain terrain feature doesn't look like it ought to, we have several means at our disposal to change it to what it should look like. By simply changing the disc we can produce a simulated radar picture of any place in about five minutes. The analog landmass simulator required about two hours of plate replacement and alignment to do the same thing. ★

OPS TOPICS

SAME SONG DIFFERENT VERSE

A few years ago a T-38 was involved in a minor accident after a no flap emergency landing. The entire sequence was set up when the ignition circuit breaker panel was installed backwards. This caused the wiring bundle to rub on the throttle cables. As a result the bundle shorted and caused a complete electrical failure. Well, recently, the sequence started again (almost) when an ignition circuit breaker panel was installed backwards. Fortunately this time all that happened was a stuck throttle. The question is—what happened to the pilot's interior preflight?

KIND OF WINDY

It has happened again. An Aero Club Cessna 150, taxiing to the runup area prior to takeoff, passed behind a C-130 that was making a ground maintenance run. The prop blast from the C-130 tipped the Cessna up on its nose gear and right wing tip. The Cessna was 229 feet from the tail of the C-130. If you must taxi behind another aircraft in runup position, be sure he is not up to power. Call ground control and ask the other aircraft to maintain idle until you are clear.

FAA ADOPTS NEW TRAFFIC MANAGEMENT SYSTEM

The Federal Aviation Administration has adopted a new, comprehensive air traffic management program designed to enhance safety and efficiency in air traffic handling, conserve fuel and reduce noise over airport communities. The FAA action was taken in response to EPA proposals for new aircraft noise-abatement operating procedures at airports. FAA said the best means of achieving the objectives of the EPA proposals is a comprehensive order directed at those who control air traffic rather than inflexible rules directed at pilots.

Called "Local Flow Traffic Management," the new FAA program is aimed at reducing low altitude flying time by jet aircraft in terminal areas. It incorporates such features as: Increased use of idle or near-idle thrust descents, metering aircraft into terminal areas consistent with airport acceptance rates, absorbing unavoidable delays at or above 10,000 feet, standardized arrival procedures and earlier climb-outs for departing aircraft.

GOOD SHOW

The FCF on an F-100 went uneventfully until flare for landing, when the aircraft started a rapid yaw to the left. The pilot felt that the left rudder pedal was moving without pressure and full right pedal pressure could not stop the movement. The pilot forced the nose gear to the ground, deployed the drag chute and used differential braking to stop. After the aircraft stopped, the pilot found the left rudder full forward and frozen in position. This pilot showed excellent presence of mind in a critical situation.

STOWAWAY

While enroute to an air refueling rendezvous, an A-7 pilot found a wasp in the cockpit. The wasp eventually lit between the right canopy rail and the canopy plexiglass. The pilot attempted to crush the wasp with his checklist. On the fourth or fifth attempt, the canopy plexiglass disintegrated. The aircraft made a safe recovery at home base. The pilot is not thought to have exerted excess pressure on the plexiglass, but the reason for the failure is undetermined.

OPS TOPICS

IF YOU PLAY WITH ICE YOU MIGHT GET BURNED

A pilot and his two passengers were returning from a local VFR flight. En route, the pilot encountered light rain but managed to remain VFR below the overcast. One of the passengers then noticed a thin film of ice forming on the wings. The pilot did not become too concerned at first until he realized that the ice formation was quickly spreading across the wing surface. To make matters worse, ice then began to form on the windshield—the pilot turned to the instruments, but they were reading erroneously! The pitot tube was covered with ice, and ice began accumulating astonishingly fast. Then the aircraft began to vibrate due to ice accumulation on the prop. The pilot found the controls to be sluggish, and it became difficult to maintain air speed and altitude. He tried to radio a distress call, but radio responded only with static—the antenna was covered with ice. The pilot and passengers panicked. Vertigo set in, and the aircraft entered uncontrolled flight. Impact occurred in an open field three miles from the airport. This entire incident happened in less than 20 minutes. The result: Two people sustained serious injuries, one minor.—Courtesy Aviation Monthly, Vol 4, No. 12, Dec. 76.

NEW FAA LOW-ALTITUDE WARNING FEATURE

The Federal Aviation Administration has added a new low-altitude warning feature to the automated radar terminal systems (ARTS III) at Washington's Dulles International Airport and Los Angeles International Airport.

Four additional ARTS III sites—Detroit, Denver, Houston, and St. Louis—are scheduled to receive the added safety feature by February 1977 and all 63 ARTS III sites by mid 1977.

The new safety feature, called Minimum Safe Altitude Warning (MSAW), automatically monitors aircraft altitudes and compares them to an altitude table programmed into the ARTS III computer. When the computer detects a potentially unsafe altitude condition with respect to terrain or obstructions, a five-second aural alarm sounds and the words "LOW ALT" appear on the controller's radar scope above the appropriate aircraft target.

Generally, MSAW monitoring begins when an aircraft enters the terminal area, which may extend outward as much as 55 miles from the airport, and is picked up by the ARTS III radar. MSAW alerts are provided to the controller automatically on instrument flight rule (IFR) aircraft and visual flight rule (VFR) aircraft when requested by the pilot. In either case, the aircraft must be equipped with the 4096-code transponder and an altitude encoder.

SLOW DOWN

An F-100D was taxiing back to the ramp on an inactive runway when a thunderstorm hit the field. With a wet surface, limited visibility, and a 20-30 knot tail wind, the pilot was taxiing with near "normal" speeds. Due to the limited visibility, the turn off to the taxiway came up a little fast. The pilot braked in the turn and entered a viscous hydroplaning condition. The aircraft yawed, departed the runway, and a main landing gear collapsed. The damage was sufficient to be categorized as a minor accident. "Normal" taxi speed can be much too fast for many conditions.—Major Lawrence E. Wagy, Directorate of Aerospace Safety. ★

mail call

Send your comments and questions to:
Editor, Aerospace Safety Magazine
AFISC/SEDA
Norton AFB, CA 92409

THE LANGUAGE BARRIER

Congratulations and well done to Major R. P. Bateman for his "What's A Cubit?" in the November '76 issue. His "assault on the language barrier," however, will probably not make much of a dent on USAF writers, most of which will no doubt continue their own assault on clear thinking and straight talk by continuing to use their own versions of the "cubit" whenever possible. As a close to home "F'rinstance," take one of the question and answer sets in the November "IFC Approach." A bewildered pilot asks what the term "fly-up" means in the ILS chapter of AFM 51-37. The IFC answer? "A fly-up indication tells you that you are below the glide path and that you must fly-up to get back on it." In other words, "fly-up" means "climb." To "fly-down", we assume, is to descend. As long as we insist that straight talk isn't good enough for us, simple assault on the language barrier isn't enough. We need to declare all-out war on people who are fond of calling a spade a "manually-operated earth redistribution device."

Incidentally, Air Weather Service has published a wallet-sized equivalent chill temperature chart similar to the one on page 21 of the November issue. It's officially referred to as AWSVA 105-12. It comes in living color, gives temperature in both old-fashioned Fahrenheit and today's Celsius and, best of all, it's free at your local base weather station.

You have a fine magazine. Please keep the good words coming.

GEORGE M. HORN, CMSgt, USAF
Weather Operations Superintendent
DCS/Operations
Air Weather Service
Scott AFB, IL

The terms "fly-up" and "fly-down" have been eliminated from the new AFM 51-37.—ed.

A LESSON FROM LARRY

I found the article in the November 1976 issue, entitled "Lesson from Larry" interesting and quite sobering for all aircrew members. Although I am not a rated officer, I have had the privilege of attending a briefing given by Brig. Gen. William Spruance (Ret.) of the Delaware Air National Guard on two occasions. I had heard him speak to the aircrew members of our unit about his experience in a T-33 crash and the effects of heat and fire on nomex clothing. He and a young pilot had taken off in the T-33 and were at an altitude of 200 feet just after take-off when they experienced flameout of the single engine aircraft.

After spending two years in a hospital as a result of burns sustained in the crash, General Spruance began an intense effort to speak to groups of aircrew members about the need to wear flight clothing properly.

I had a second occasion to hear General Spruance's presentation as an Officer Candidate at the Air National Guard Academy of Military Science in Alcoa, Tennessee in 1974. At that time, his briefing included color slides of his condition immediately upon entrance to the hospital and after two years of treatment. To anyone who saw these slides and heard his presentation, the impact of both was thorough and, I am sure, remained distinct in our minds.

As an addition to his presentation, the General provided much data compiled from other aircraft accidents that involved burns to aircrew members. He showed statistically and pictorially, that areas of skin not protected by nomex material were more severely burned, and that nomex gloves and suits —even ordinary clothing—will offer more protection against skin burns.

RAYMOND A. PATRONE, 1st Lt
143 Tactical Airlift Group
R.I. Air National Guard

NAME THAT PLANE



Can you name this aircraft? This early assault aircraft was a forerunner of the C-130 and was the first of its type designed with a wheel-ski combination. (For the answer see the inside front cover.)

* * *

CALCULATORS ON AIRCRAFT

ASD has tested and approved for use on board aircraft several models of calculators.

Sharp EL 816
Olivetti Divisuma 18
Cannon Pocketronic
Texas Instruments Datamath TI-2500, SR 50, SR 52
Commodore mm3m
Hewlett Packard HP 25, HP 45, HP 55, HP 65
Nav Tech NC-2

These calculators were evaluated by ASD at the request of using organizations. ASD has certified them as not affecting safety of flight. However, there is a slight chance that in some high electromagnetic energy environments the calculators may give incorrect answers. If such an instance occurs, advise ASD/ENAMA and your MAJCOM safety office by priority message.

* * *

CORRECTION: The Ops Topic "How to Zap TA" in the December 1976 issue was incorrect. What actually happened was that, while the canopy was not jettisoned because it was open, all the canopy jettison explosive components functioned.

☆U.S. GOVERNMENT PRINTING OFFICE 1977 789/855/42

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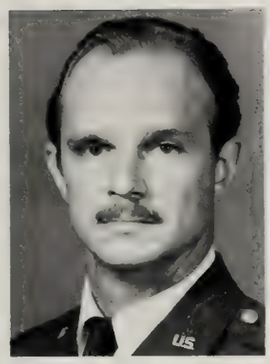
Accident Prevention

Program.



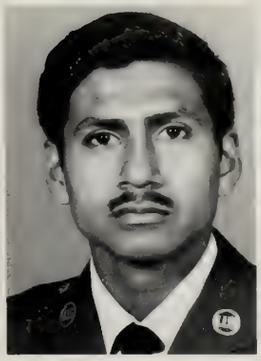
CAPTAIN

Horace E. Johnson



CAPTAIN

Alan C. Murphy



STAFF SERGEANT

Marcelino Martinez

24th Composite Squadron

On 9 August 1976, Captain Johnson, Captain Murphy, and Staff Sergeant Martinez were engaged in the infiltration—exfiltration training of a combined USAF Combat Control and US Navy SEAL Team. Prior to flight, the trainees, who were to climb up to the aircraft on rope ladders and then rappel to the ground, were thoroughly briefed on emergency procedures by Sergeant Martinez. After takeoff, initial hover was established at 35 feet above the ground and the first three trainees were cleared to the ladders. As the first two trainees began to ascend the ladders, all tail rotor thrust was lost. The aircraft began a clockwise spin, with a slight nose "tuck." Captain Murphy quickly analyzed the critical situation, retarded the throttles to flight idle, and executed a hovering autorotation. During the descent, the aircraft continued to rotate through two full 360 degree turns. Through close crew coordination, the nose tuck was corrected by cyclic control inputs and by reference to the sweeping horizon. As these events occurred, the trainees trapped on the ladders and the trainee stabilizing the ladders were able to follow the pre-briefed emergency procedures and roll clear of the aircraft without injury. Just prior to touchdown, the collective pitch control was increased to minimize the rate of descent. At touchdown, the rotational inertia of the aircraft and grassy cover of the landing site allowed an additional 30 degrees of turn to occur. The mission planning, briefings, crew coordination, and the instantaneous correct actions of the flight crew and trainees resulted in recovery of the aircraft with minimal damage and no injury to personnel. The elapsed time from control failure to touchdown was less than 10 seconds. Subsequent investigation revealed a failure of the tail rotor drive quill shaft coupling which resulted in the complete loss of tail rotor thrust. The professional competence of the flight crew can be credited with saving a valuable aircraft and averting injury. WELL DONE. ★

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SAFETY MARCH 1977



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ABOUT THE COVER
UH-1N helicopter, manufactured by Bell Helicopter and used by Air Rescue Service and TAC Special Operations.

MARCH 1977

UNITED STATES AIR FORCE

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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NAME THAT PLANE ANSWER

The XF-91, built by Republic Aviation, began tests in 1949. The aircraft, powered by a single jet engine with rocket motors for accelerated takeoff and climb, was 45 feet long with a 30 foot wing span. It was one of many aircraft designed early in the jet era which never made the production line.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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MARCH 1977 AFTR 127-2 VOLUME 33 NUMBER 3

Near Miss



CAPTAIN JAMES P. COE, 14 FTW, Columbus AFB, MS

Many errors are caused by having our mind set to receive certain stimuli: seeing what we expect to see. This expectation may cause us to see what is not there or fail to perceive the importance of the information presented. This is known as "psychological set," which is not uncommon. Under certain circumstances it can be dangerous.

An air traffic controller was assigning trainer aircraft to local training areas under positive radar control. He assigned several training areas and had Areas 4 and 5 left open. Another controller, working arrival control, received a request from a pilot for a training area. The arrival controller wanted to help the pilot and the departure controller, so he assigned the trainer Area 5 Low. He completed the air traffic control strip and posted it in the Area 5 assignment bay.

The departure controller soon received another request for an area from a trainer that was close to Area 5. Believing that Area 5 Low was empty, he assigned it, made a strip, and placed it in the open bay he thought was Area 5 Low. In reality, he had placed the clearance strip in the Area 4 Low bay. Both trainers checked in with radar area monitor. This controller believed the strips to be in the correct bays and heard what he expected: one aircraft in Area 5, one in Area 4.

The instructor pilot rapidly assumed control from the student pilot and pushed over to avoid the other aircraft. The two trainers made contact and established their own separation. They contacted arrival control and requested separate recoveries. Only good clearing, good weather, and good luck avoided a tragic midair collision.

The best preventive for the problem of mental set is to expect only the unexpected. Analyze the points in your individual mission or job where you are set to see or hear predetermined information. Learn to expect engine instruments, fire warning systems, gear position indicators, air traffic control clearances, or radar scopes to give unexpected information. To fight boredom and complacency, you must plan to concentrate on the entire environment to avoid hazards. ★

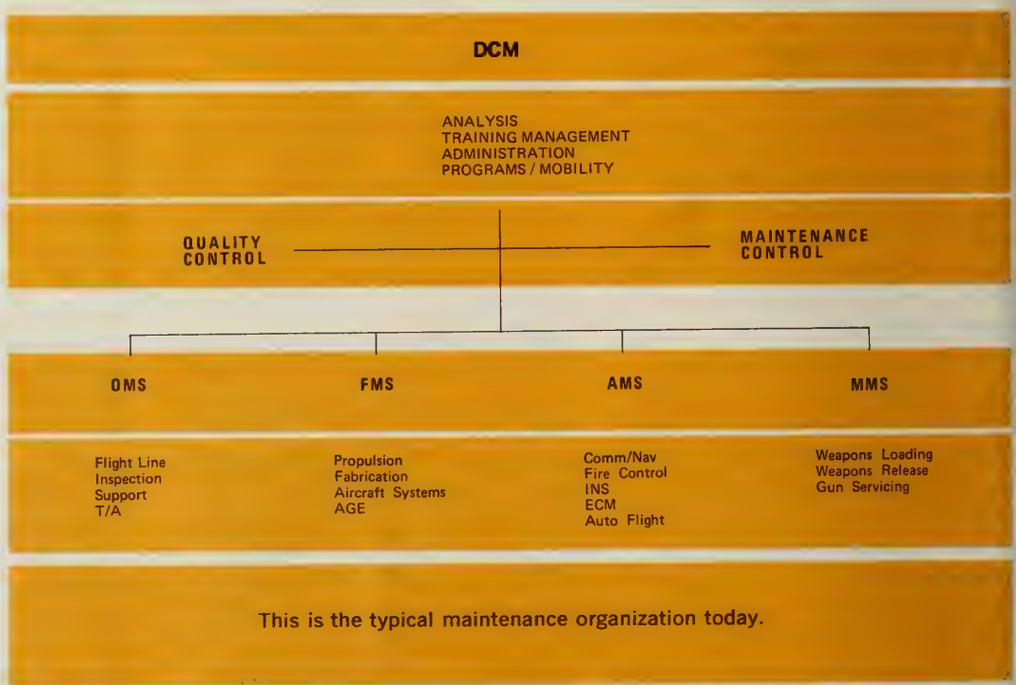
Production Oriented Maintenance Org

POMO A NE

A significant change in the maintenance organization in our tactical forces has been tested and is being implemented. Aircrews as well as maintenance people should understand the concept. Major General Nelson provides a preview of what's coming with POMO —Production Oriented Maintenance Organization.

Aircraft maintenance people are the hardest working group in the Air Force—at least we in the business think so. In recent years, while the magnitude of the task has remained the same and resources to get the job done have diminished, it seems the motto of the maintenance community has become "never mind the mules, load the wagon."

To say that base level maintenance today is a management challenge is an obvious understatement of the issue. Every base maintenance organization in the Air Force has many people who are working long, hard hours to meet our flying



This is the typical maintenance organization today.

zation

ONCEPT

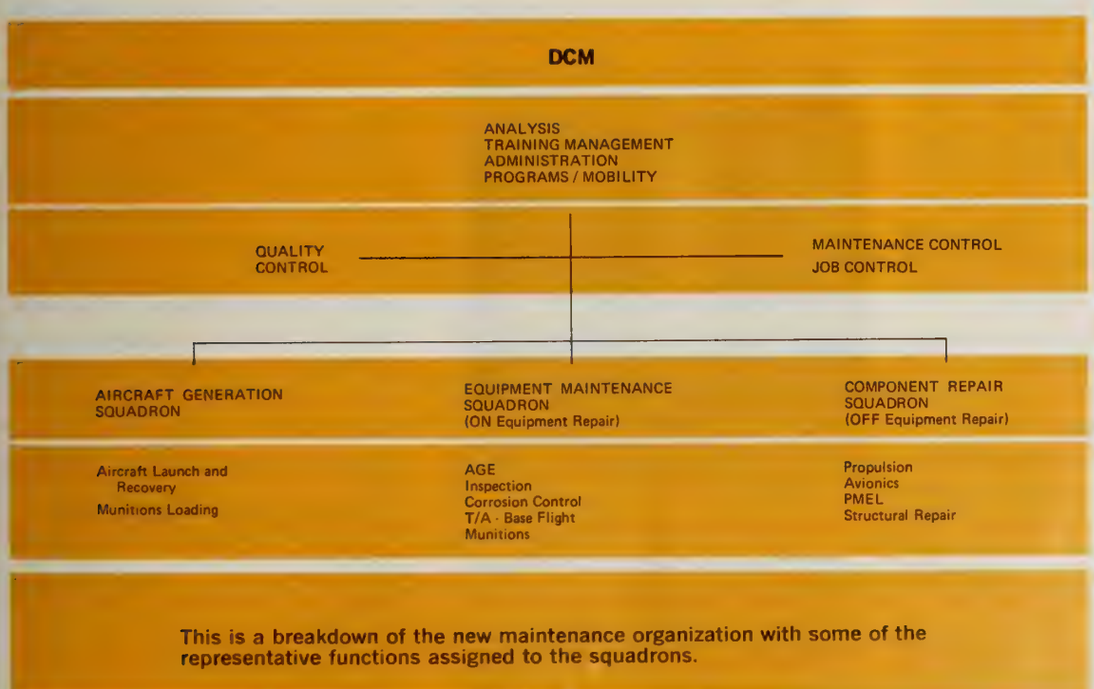
MAJ GEN WILLIAM R. NELSON
HQ USAF
Director of Maintenance, Engineering and Supply

programs and achieve the increased readiness and sortie production/surge capability the Air Force is seeking. However, given the constraints in people and dollars we are faced with, there is a limit to how much "running faster, jumping higher and sweating more" we can do without some major changes in the way we go about our business.

Recognizing this, the Chief of Staff established the Maintenance Posture Improvement Program to find new ways of going about the complicated business of maintenance which would permit more efficient and effective use of the total Air Force maintenance resources. As part of this effort, Tactical Air Command developed and extensively tested a new base level maintenance organization called the Production Oriented Maintenance Organization (POMO).

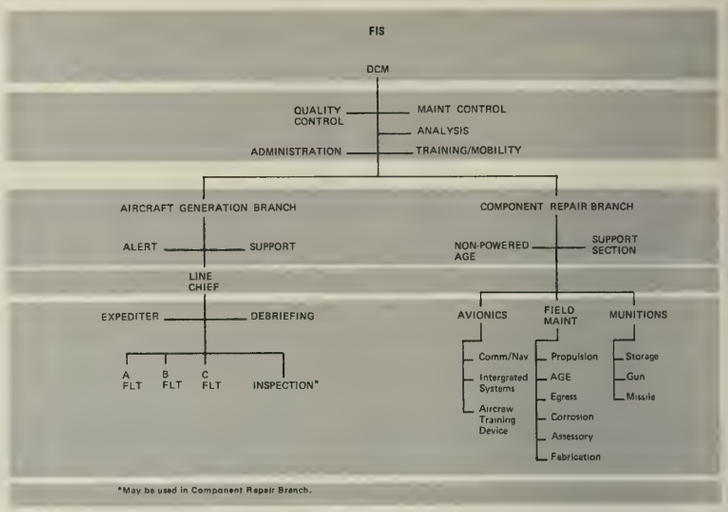
Basically, the POMO concept divides maintenance specialists into two production groups based on the type of maintenance they perform—either on-equipment or off-equipment. Specialists from the avionics, field and munitions maintenance squadrons who do on-equipment work are assigned to the flight line along with the crew chiefs. Specialists are trained in a related specialty and everyone is task qualified in common flight line jobs such as towing and servicing aircraft. The off-equipment specialists can now be placed in a pure production environment, uninterrupted by the requirement for flight line dispatch.

POMO offers several distinct advantages. First, it gets the on-equipment people closer to the job—and reduces the built-in delays of the AFM 66-1 specialist dispatch system. Second, by placing the people on the flight line that you need to turn aircraft, the sortie production and surge capability of the unit is



This is a breakdown of the new maintenance organization with some of the representative functions assigned to the squadrons.

POMO



enhanced. Finally, we believe it returns a lot of the decision making authority—which has been eroded over the years—to junior officers and senior NCOs on the flight line to get the job done.

The POMO concept has been accepted in principle by TAC, PACAF, USAFE, ADCOM and the National Guard Bureau. TAC has an established POMO in the F-4 wing at MacDill and in one flight of the F-15s at Luke. ADCOM has implemented POMO in the 48 FIS at Langley, and USAFE and PACAF are both moving toward POMO for their tactical units beginning early this year.

The organizational charts shown give a snapshot of what a Production Oriented Maintenance Organization looks like—notice the three maintenance squadrons (with new names) versus the four in an AFM 66-1 organization.

A draft Air Force regulation has been written and will replace AFM 66-1 as the procedural directive in the TAC, PACAF, USAFE, ADCOM and NGB POMO units. We believe POMO is a significant step toward increased readiness in the fighter commands. ★

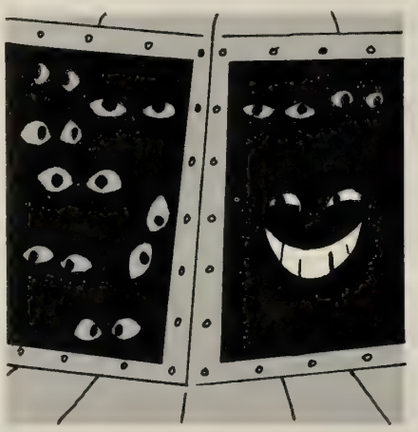
Extra Eyes

MAJOR BOBBY R. REMINGTON, Directorate of Aerospace Safety

"Traffic at one o'clock low and appears to be crossing in front of us!" Now, more than likely, the pilot has the traffic in sight, but he sure likes to hear other crew members sound off. It is always nice to have those extra eyes look for other aircraft.

Just because you are a navigator, copilot, flight engineer, or additional crew member, and you have your prescribed duties, there is no reason why you can't take an extra second or two to scan the outside area for traffic. Remember, you are in the aircraft, too, and you also are responsible for its safety.

There have been times when I have been discouraged after I



yelled out that I saw traffic and then had the pilot say "I see it!" But, there's always that one time when he says "Thanks, I didn't see it!" You just might have saved everyone's life plus the airplane, and that makes it all worthwhile.

Don't be afraid to call out traffic—even if you have a pilot who may be a bit edgy. I've had pilots, who were busy with an emergency, yell at me for calling out traffic—but later on the ground they have ALL apologized and requested that I not stop telling them of any traffic that could affect the safety of the aircraft.

One important thing to remember, however, is that you don't call out that aircraft that is two thousand feet below and at your eight o'clock position, heading the other way.

Be reasonable and use good judgment! ★



2D LT MICHAEL N. WETHERELL, 363 OMS, Shaw AFB, SC

Everyone enjoys watching an air show. It's amazing what an airplane can do. But, after the last plane comes in for a landing and taxis off, spectators turn their attention to something else.

Did you ever wonder what happens to an aircraft after it lands? Do you think it just sits on the ground waiting for the next time someone wants to fly it? That is not how it works. A plane is like anything else; it breaks, it leaks, it rusts, and it gets dirty.

Let me tell you about a man called the "Crew Chief." He's barely out of his teens, and yet, he is responsible for a multi-million dollar piece of equipment. He's the one who fills the tanks with fuel, services the engines with oil, pumps air into the pneumatic system and fluid into the hydraulic system, changes tires, and does the hundreds of other little jobs necessary to keep his plane flying. Day after day he's out there working on his plane—adjusting, inspecting, polishing, repairing. He doesn't care how bad the weather is; he works through broiling summer afternoons and cold, windy downpours that would scare a mailman. The only thing he cares about is getting that plane in the best condition possible. So you see, it's not the skill of the pilot alone that so gracefully performs maneuvers. Those aircraft are held together by the skinned knuckles, the strained muscles, the warm sweat, and the calloused hands of these dedicated young men and women. Without the crew chief to faithfully perform his thankless job, the best pilot in the world would never get off the ground.

The next time you have the opportunity to watch an aircraft perform, don't turn your back and walk away after it has landed. Stay, and for just a minute, take a good look at the young man who is patiently waiting for the pilot to shut down the engines so he can begin his work. Nowhere in the world will you find an individual more conscientious than he.

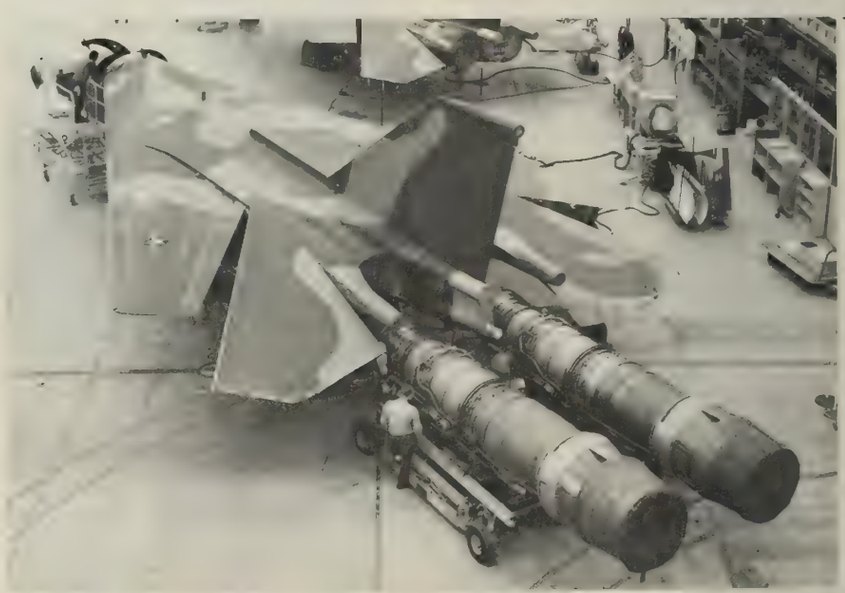
Now go. But remember, long after you have left, the crew chief will still be there doing his job. ★

TF30
Integrity Assurance Study Group

LT COL FRANK B. PYNE, Directorate of Aerospace Safety

In mid-76, the commander of AFLC chartered a group of general officers to review the TF30 engine and determine the reasons for the increase in engine involvement in F-111 accidents. The primary purpose of the evaluation was to identify failure modes that had a high probability of causing the loss of an aircraft. Once the causes were identified, the group was to recommend procedural and/or hardware changes to reduce the risk and/or eliminate the failure modes. The Integrity Assurance Group was quickly dubbed the "IASG", an unpronounceable acronym.

The IASG was organized into four working panels: operations, field maintenance, depot overhaul and engineering. Each major command operating the F-111 and propulsions engineers from ASD participated in the study. The panels traveled to all the CONUS F-111 operating bases and one team spent almost 5 weeks at Oklahoma City ALC reviewing engine overhaul procedures and practices. After initial fact finding, the group reassembled at Wright-Patterson



High performance engines of today are less tolerant of abuse than their predecessors. "Integrity Assurance Study Group" consisting of general officers studied TF30 engine.

AFB to present the data to a general officer steering group and to discuss cause and effect with the other panels.

To provide an interface with airline and industry personnel addressing similar problems with engines, an advisory panel of civilian propulsion engineers and management supervisors were invited to sit in on some of the discussions and advise as they saw fit. Additionally, the Navy was just completing a similar review of the TF30-412 used in the F-14. The findings and recommendations of that study were made available and reviewed by the IASG.

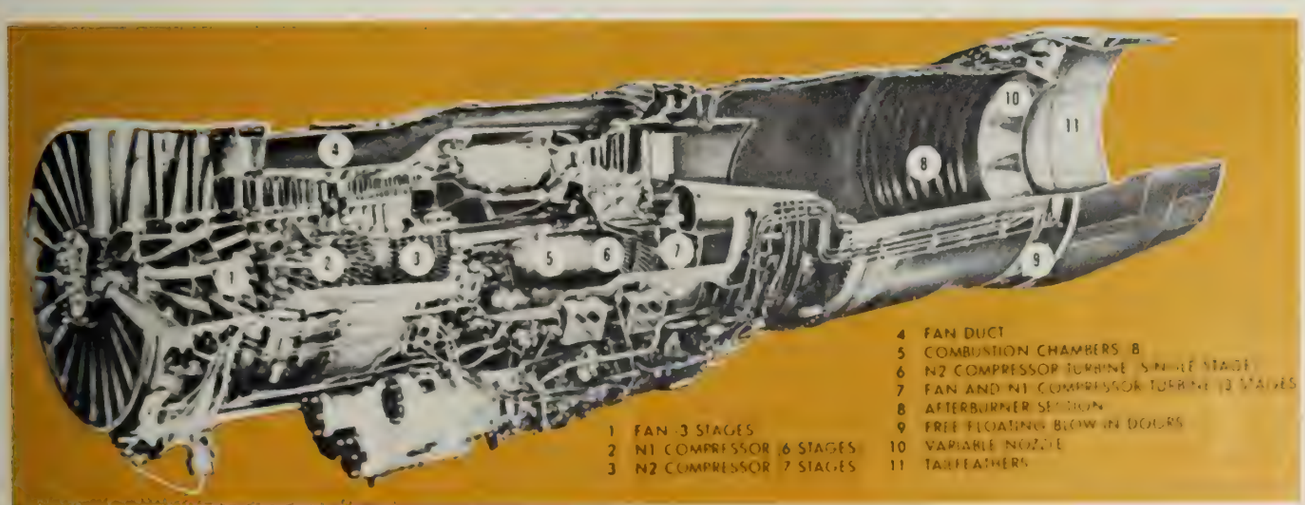
The engineering panel visited the engine manufacturer and reviewed the development history of the TF30. The operations and field maintenance panels expended untold man-hours attempting to uncover a difference in either usage, mission cycle, or maintenance techniques to explain the higher occurrence of failures in certain TF30 models and in some major commands. Each difference was carefully documented and discussed with the engineering panel for a cause and effect relationship.

Each panel had a list of questions prepared by the steering group to stimulate thought. The panels had additional help in this area because, as it turned out, **everyone** associated with the F-111 or TF30, some very remotely, had a theory for the failure causes. Although many opinions had been offered and solutions suggested, this study was especially sensitive to each and made every attempt to confirm or deny each one.

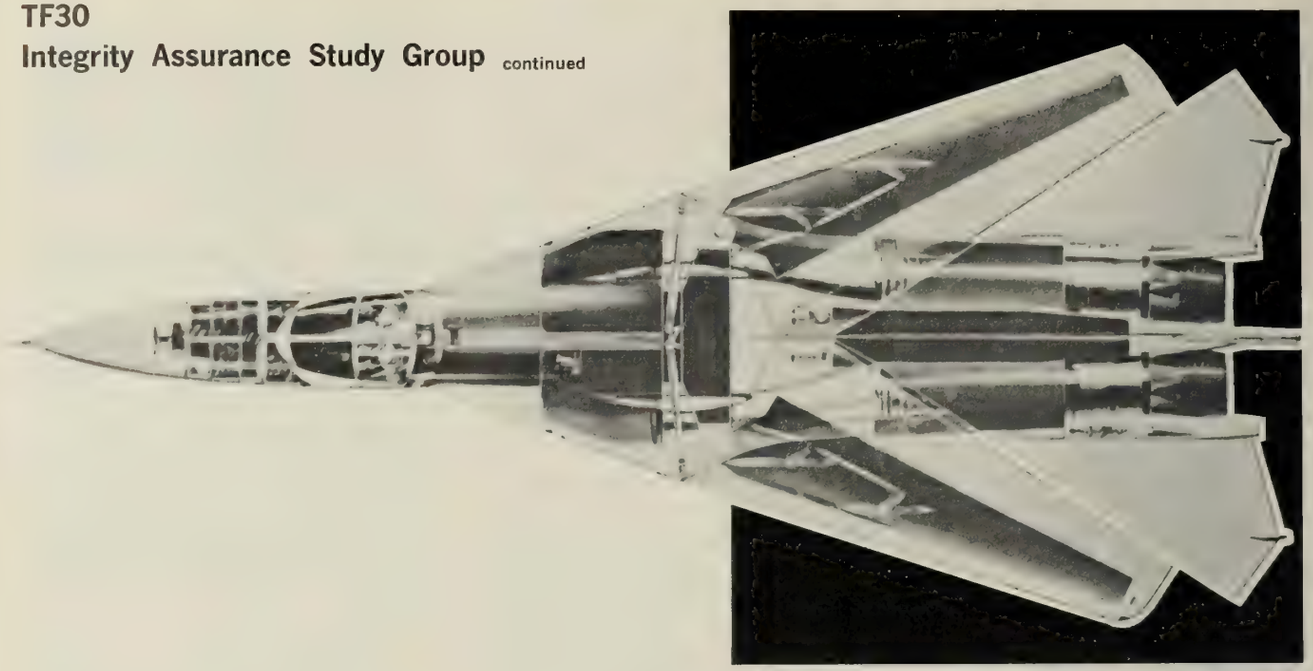
The TF30 was developed under a military specification which essentially directed that it be designed to pass a 150-hour military qualification test (MQT). This test was equivalent to 43 service hours for the high pressure turbine, 90 service hours for the fan section, 170 service hours for the hot section and 187 service hours for the low pressure turbine. Critical parts and life limits were largely undetermined and, while a life limit was established for each disk, verification of life limits by testing was not required and had not been accomplished. These requirements were compared with the F-111 airplane which has been full-scale fatigue tested to 40,000 hours to certify 10,000 hours of airframe service life. An engine usage survey had not been accomplished since 1973, although there is continuous monitoring of airframe usage via onboard recorders on every fifth airplane.

Since the TF30 and F-111 were developed, significant changes have been made to the engine design specifications to bring engine life more in line with airframe life and provide a more durable engine. Presently, the engine must be designed to a defined duty cycle, low cycle fatigue (LCF) life must be determined and a 100 percent margin designed into the engine.

The engineering panel, aware of these limitations, reviewed the mishap history looking for a common failure mode. All areas of the engine from stators to bearings, to hot section, to exhaust nozzle, as well as plumbing accessories and controls were reviewed. Years of experience have been gained from observing critical engine parts since the TF30 was designed. With the benefit of this knowledge the engineering panel determined that additional critical parts needed to



TF30
Integrity Assurance Study Group continued



be identified. These parts will require an assessment of LCF life, and management (tracking) must begin. This is especially difficult after prolonged untracked usage.

The first significant finding was that the fan blade failures experienced to date in the TF30 were LCF failures originating from a stress riser in the blade. Prior to this study, the life of TF30 fan blades was thought to exceed the expected service life (10,000 hours) by such a large margin it was designated infinite. Because the blade life was thought to be infinite, the usage was not tracked.

The enhanced fan section program was formulated to remove from service those fan blades with minute imperfections which act as stress risers. The purpose of this, of course, is to eliminate the failures. However, it also will provide sufficient time to determine the life of the blades and procure a redesigned fan blade, or to design into the engine case or airframe protection for the aircraft fuel cells if a fan blade fails.

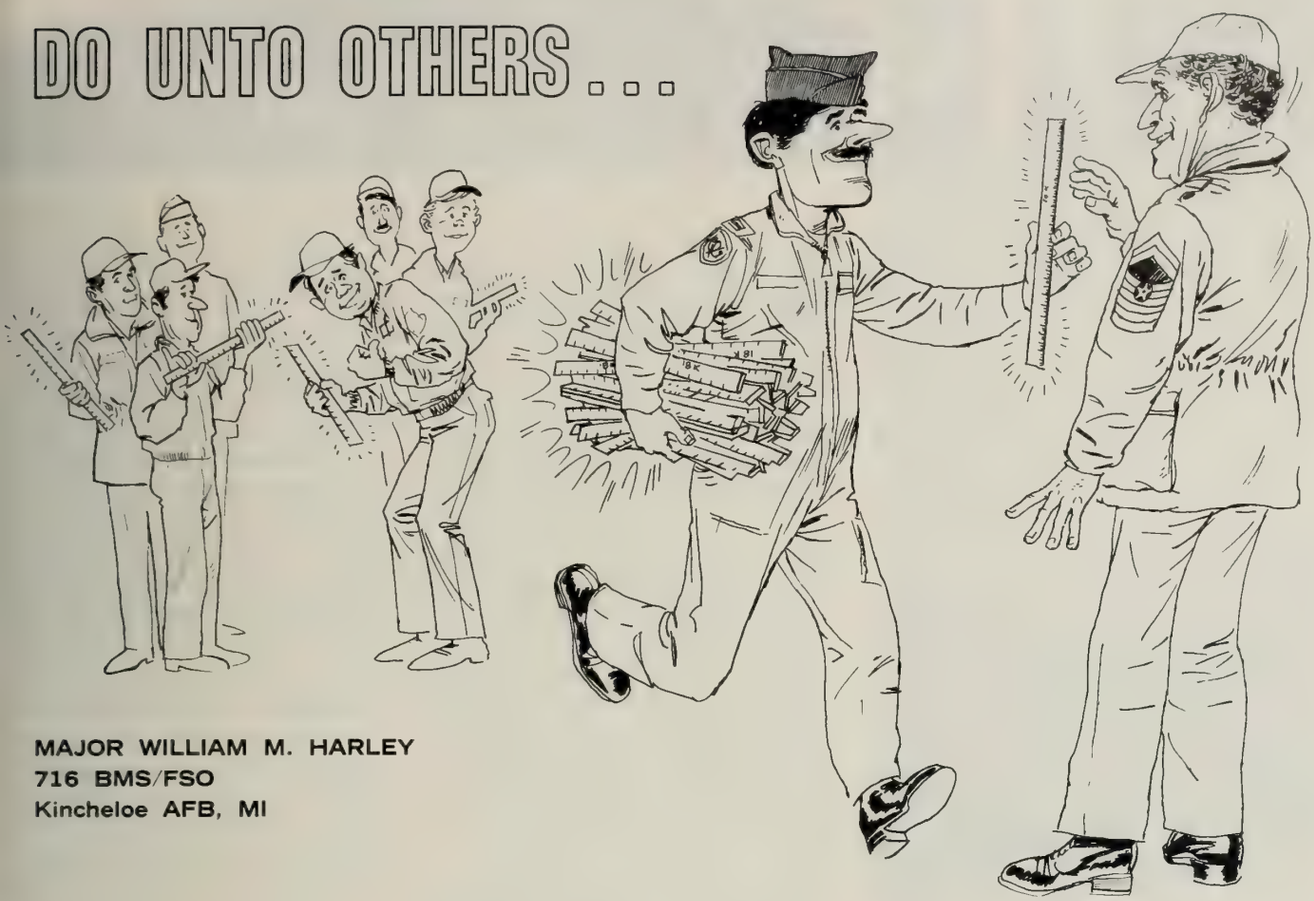
The study group also found that other failures within the engine either originated from an LCF-initiated crack or were pure LCF failures. This led to the conclusion that a front-to-rear life analysis was required for the TF-30. The findings of this analysis must then be verified by testing, if the engine manager is to have any possibility of predicting failures and taking corrective action before the effects on the TF30 engine inventory become traumatic.

The TF30 has experienced four disk failures. Two third stage disks failed due to a vibration that caused disk failure in high cycle fatigue. Two 14th stage disks failed due to softening by a fire which occurred after oil got into the N^2 rotor cavity. Overfilling, coking and oil foaming are all being investigated as possibly contributing to the failure.

These major findings were determined to be either immediate or short term. The study group determined that future integrity of the TF30 depended on a timely management decision to incorporate corrective actions before catastrophic failures occur in service. For this program to work and be successful, engine usage must be defined and tracked, the duty cycle defined and accelerated mission cycle testing accomplished to provide the visibility the engine manager needs to take corrective action.

The TF30 and the high performance engines now coming into the inventory are all less tolerant of abuse than previous engines; however, the installation is especially critical in the F-111 surrounded by fuel cells. By way of contrast, the TF33 (C-141, B-52H) has experienced more than 50 in-service fan blade failures to date. Unfortunately, failures that do not cause the loss of an aircraft are not long remembered and reappear in other aircraft and engines. ★

DO UNTO OTHERS . . .



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In a speech at Wright Patterson AFB last August, General F. Michael Rogers, Commander of Air Force Logistics Command, suggested that we in the Air Force pause to consider "How the Golden Rule Can Benefit Our Mission." What he meant was simply to treat the people with whom you work as you would like to be treated—with respect. He was talking to the officers and senior supervisors when he said, ". . . get to know *and use* the names of the people with whom you deal. Greet them with a friendly smile and a friendly hello, good morning, or how are you?" Sound familiar? Sure it does. We all make an effort to do these things—don't we?

What does this have to do with flying safety? Well, it could have a lot to do with it. We in the USAF want to be the best and we want to do what we do in the safest manner possible. Certainly for the aircrew types, treating the people on the flight line—the maintenance supervisor, the crew chiefs, technicians and debriefers—with the courtesy, friendliness and respect due to the men and women who help to get our job done just seems to be a smart way to do business.

You have to believe that a man will do a better job for you if you treat him well. Crew chief X may do a bit more and a bit better if he thinks it will help to ensure that a friend will have an easier, safer mission because of his efforts. You'd feel a lot better if your crew chief was concerned with your safety—right? I've seen it work You've seen it work; but it's easy to forget. The leader who fails to use all of his available support to best advantage is not getting the most from available resources!

People have always craved recognition. With only a little extra effort you should be able to use the names of most of the people on the line. In your daily contacts with people, don't treat them as strangers—give them your personal, considerate attention and let them know you have confidence in them. Maybe it will help just a little toward making things run just a bit smoother for you; toward getting the job done. Perhaps the folks working on your aircraft will be a little more concerned for your welfare. Before you know it they will be using your name too!

Try it. See if the benefits don't become immediately obvious. See if it doesn't feel good, and see if we don't have a safer, more accident free year. ★

THE IFC APPROACH



Recent accident and incident data taken from National Transportation Safety Board (NTSB) report NTSB-AAS-76-5, a study of civil aircraft flying ILS approaches, indicated that almost every mishap in low visibility conditions occurred after the flight crew had either seen the ground, the airport, or the runway enivronment and was attempting to transition from instrument to visual flight procedures. For the most part, crew members involved in these accidents elected to continue the approach visually based on cues which did not adequately portray their vertical position, relative to the runway. In most cases, a short landing resulted. Why?

One reason may be that approach design minimum visibility is predicated on the distance at which the approach lights come into view. Approach lights provide fairly good lateral and roll guidance but little vertical position guidance. This could possibly lead us into the trap of continuing the approach without sufficient visual cues.

Another problem brought out by the Air Line Pilots Association All Weather Committee, is that the sudden appearance of runway lights can produce the visual illusion that the aircraft is too high or that the nose has pitched up. Combining the situation of being able to see only the approach lighting system and the illusion that you are too high could very well lead to a short landing.

Crew members must constantly be aware that they should have not only lateral visual reference with the runway environment to continue an approach past decision height (DH) or minimum descent altitude (MDA), but also should have sufficient references for vertical guidance. If a crew is uncertain of their exact vertical position, a missed approach is the only safe alternative at DH or MDA. Even when the crew is assured of their vertical position only continued reference to the vertical velocity indicator (VVI) and/or glide slope indicator and/or continuous attention to the instructions of the Precision Approach Radar controller will provide the crew with a complete vertical position representation.

Accident data in the NTSB study disclosed that the pilots involved in these accidents were apparently unable to correctly assess the flight path or descent angle of their aircraft during the visual segment of low visibility approaches. The NTSB concluded that only timely and proper integration of flight instrument data into the pilot's cross check can detect or prevent undesired excursions from the desired flight path, during instrument approaches.

The following NTSB recommendations to civil air carriers may also apply to Air Force operations:

1. Implement flight crew coordination procedures which will ensure continuous monitoring of the aircraft's instruments from outer marker to landing. The wording of monitoring tasks should be specific. Flight crew procedures which require a transfer or exchange of visual scanning responsibilities should require that the appropriate crew member announce that he is relinquishing previously assigned duties or responsibilities.

2. Develop flight crew coordination procedures which will limit sighting callouts to those visual cue

By the USAF Instrument Flight Center
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which are associated with the runway environment. Unrequired callouts which can result in the premature abandonment of instrument procedures should be prohibited.

3. Develop a standard flight crew coordination procedure within each carrier for altitude callouts to be used on all approaches under all conditions.

4. Encourage flight crews to keep the autopilot-coupler engaged until its minimum certified altitude has been reached.

5. Include in air carrier training programs, flight crew discussions of formal reports involving approach and landing accidents or incidents. Special emphasis should be placed on those mishaps involving human limitations.

Human limitations often result in the commission of two fundamental errors during a normal, low visibility approach. First, when the runway environment comes in view, the instrument cross-check is abandoned and, consequently, orientation with an electronic glide path, or predetermined descent gradient in the case of a nonprecision approach, is lost. Secondly, sudden total reliance is placed on highly compromised visual landing cues; cues which may not only misrepresent the actual relationship of the aircraft with the runway, but may appear one moment and disappear the next. Many of us, perhaps, have developed habit patterns which will, on a given day, contribute to an accident. For example, we may discontinue reference to the VVI during practice instrument approaches, after transition from the approach to the landing. If we don't monitor the VVI during practice, we probably won't at any other time. Instructor pilots who require their subject crew members to rely solely on the gauges until reaching the missed approach point and then suddenly look up and become reliant upon only visual cues for the remainder of the approach should, perhaps, reevaluate their techniques in this area.

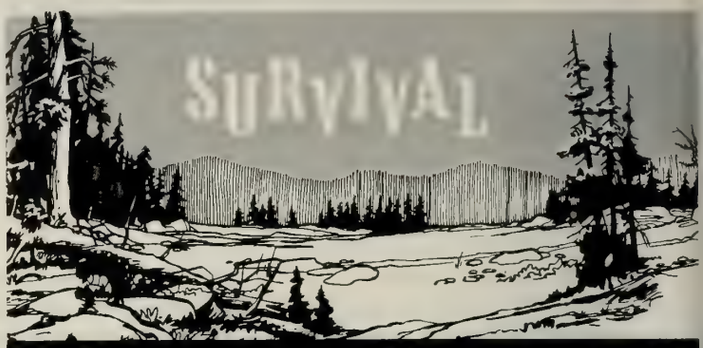
During the Landing Weather Minimum Investigation (LWMI), conduted by the USAF Instrument Flight Center, an interesting fact was brought to light concerning visual cues available during low visibility approaches. If an RVR of 1200 feet exists at decision height (DH), the pilot's aiming point and runway threshold will not be in view although sufficient visual references may be available for lateral alignment. Lateral alignment cues may be insufficient for vertical alignment. If the touchdown point cannot be seen, vertical position cannot be adequately determined, for flare purposes.

Crew procedures used during the LWMI were established to provide runway sighting callouts by the crew member not flying the approach. The first call was "CUE" which meant that portions of the runway environment were coming into view. The second call was "LATERAL" meaning that the visual cues were sufficient to laterally align the aircraft with centerline, but, insufficient visual information was available to flare the aircraft. When the visual pilot had sufficient references to visually control the aircraft he called "VISUAL." Callouts used in the LWMI are just some of many possibilities. Any crew type cockpit configuration easily lends itself to similar procedures.

Sandardization/Evaluation or flying safety meeting discussions among crew members could be a good source of possible techniques for coping with low visibility approaches.

The point is, landings in limited visibility present many psychological obstacles, such as apprehension and uncertainty, as well as the physical obstacle of the particular restriction itself. Procedures, as well as skills, to continue monitoring instruments past DH, must be developed if such conditions are to be safely coped with.

To successfully integrate a visual scan for the runway into an instrument cross-check, the pilot must periodically look out, even when visibility restrictions preclude him from seeing anything. This allows the pilot to begin picking up landing cues as soon as they appear. Also, an established periodic scan eases the transition from instruments to visual. Various instrument maneuvers require flight instruments to be brought into the cross-check in various ways. A gyro out radar approach, for example, could require the inclusion of the turn and slip indicator, whereas at most other times it is seldom needed except for occasional reference. Cross-check during an instrument approach requires inclusion of a periodic runway scan, as if it were a flight instrument, and when taking over visually, periodic reference to VVI may prevent a fatal undershoot. Occasionally, we may find ourselves attempting to land in conditions we hadn't counted on. Careful thought and planning, now, may save a valuable crew and aircraft. ★



Personal Survival Kits

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Photograph by A1C Mike McGowan

Often survival is associated only with aircrews, therefore, many Air Force members consider themselves immune from a survival experience. This type of attitude can leave you totally unprepared. A snowstorm in North Dakota, a tornado in Oklahoma, a hurricane in Florida, or a flat tire in Arizona could be the prelude to a survival experience. This type of situation could happen to any Air Force member, including you, thus it is a necessity to be prepared, regardless of your job or location.

What type of preparation do you need? Initially, you should concentrate on acquiring some basic survival knowledge. Such knowledge can be obtained from magazine articles, books, such as "ALIVE," survival schools, continuation training or special classes by area schools.

Preparation goes further than just having the knowledge; it also involves equipment. Having the necessary equipment for the situation enhances your chance of survival. You don't want to carry a backpack loaded with survival gear every place you go, but some of the equipment in that pack may be nice to have. What equipment do you need? How can you carry it? How can you ensure that you will have it when needed? The answer to all of these questions is the PERSONAL MINIMAL SURVIVAL KIT. Personal, in that you decide what you need. Minimal, in that only the bare essential items are included. And it's a survival kit because you can easily carry it with you anywhere and have it when you really need it.

The contents of a kit are determined by environmental factors and personal requirements, thus no two kits need be the same. They all should, however, meet specific criteria: (1) All items must be necessary, (2) They must be practical, (3) They must be compact. A good example is that a gas heater might be necessary for survival in the arctic, but it is not practical for inclusion in a kit because it is not compact enough. Many survival kits are dumped before they are ever used simply because they are too bulky or cumbersome and become a nuisance.

Outdoor magazines and recreational supply catalogues all have advertisements for minimal survival kits. These kits range in price from $5.00 to $80.00, yet they are not as good as the one you can design and construct yourself, because yours can be designed for a specific person in a specific location. Additionally, most of the items can be found around the home, greatly reducing the cost.

The simplest kit, and the one that is easiest to carry, is the pocket survival kit.

To construct this kit, you will need the following:

PEN An inexpensive, plastic, fat barrel pen is the best. Remove the cartridge filler and spring. (A penlight barrel also works well).

MATCHES Cut a plastic straw the same length as the pen, and seal one end of the straw by melting it or filling it with wax from a candle. Break several wooden matches in half and place them inside the straw so that their heads do not touch. Seal the other end of the straw. The straw can be used later as tinder in starting a fire.

NEEDLE Magnetize a needle by rubbing it with a magnet. Hang it from a string and note which end points to north. Paint that end. Drop it into the pen barrel.

SAFETY PINS Drop two small safety pins inside the barrel.

KNIFE Find a sharp blade, small enough to put into the barrel. A single edge razor blade normally fits. It is best if the blade has a hole in it; that way, the two safety pins can be used as a handle.

BIRTHDAY CANDLE If possible,

get a "magic" birthday candle. If the wind blows it out, it will relight itself. These are common items, but you may have to shop around a bit. If you can't find one easily, try your local neighborhood magic and novelty shop.

WIRE Squeeze some very thin, pliable wire (snare wire) next to the candle and matches so that the end protrudes from the hole in the barrel.

FOIL Fold and tuck a piece of aluminum foil around the candle, matches and wire. This can be used as a reflector or signal mirror. If the pen barrel is large enough, you may be able to pack enough foil into it to make or line a cooking pot. If there is any remaining room, try stuffing in other items, such as iodine or globaline tablets for use in purifying water.

Larger kits can be constructed by using plastic cigarette cases, plastic soap dishes, band-aid boxes or a tin can. Such kits are practical for placement in autos, boats, backpacks, etc. The number of items and the items themselves are again determined by the designer. Remember, special attention should be given to medications needed by yourself or members of your family.

The items in this sample kit are:

PLASTIC Handled carefully, it can be shelter, raincoat, or a sleeping bag (when filled with dry leaves, needles, grass, etc.). It will hold body heat in and minimize effects of the wind. In desert areas, it can be used in the construction of a solar still. In order to get it compact enough, it will have to be pricked with a pin to release the trapped air. This will not affect the waterproof qualities of the plastic.

MATCHES Matches are laid with heads alternating, with the second row placed at 90 degrees to the first row. Melt wax over the entire stack. The wax makes the matches waterproof and buoyant.

SAFETY PINS Varied sizes.

FISH HOOKS Sizes 10, 12, 16, plus 16 to 20 feet of 10-pound test line.

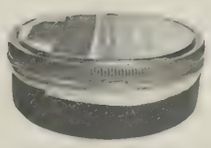




Items pictured right and below, stored in body of a fat-bodied ball point pen, make an excellent mini-survival kit.



Shoe polish jar makes equally good container. Select items to meet your own particular needs.







KNIFE Multiple-bladed small knife. Be sure to sharpen and oil it prior to packing.

MAGNETIZED NEEDLE Paint the end that points north.

BUTTON COMPASS These can be bought at a toy or sporting goods store for less than a dollar and the adage "what you pay for is what you get" holds true in this case. Don't spend a fortune, but do buy a good compass. It can be the most valuable item in the kit.

BALLOON OR PROPHYLACTIC Use as water container.

BOUILLON CUBES One or two provide a warm drink that really boosts morale.

SALT Place into a sealed straw.

SNARE WIRE

WATER PURIFICATION TABLETS

CAN LID Polish the lid of a tin can so that it can be used for a signal mirror; punch a small hole in the center of the lid for sighting purposes. Seal the lid on the can with wax or plastic tape.

Well, that's about it. The kits are ready. Are you? Try the magnetized needle to see if it actually points north. With the plastic, try constructing a shelter or sleeping bag. Once you know how to use each item, seal the kits and place them where they will most likely be needed. Put the pen kit in your flight suit, purse, field jacket, etc. Remember, the real value of a personal survival kit is that when faced with a survival situation, you will have this life saving equipment with you. It's a totally useless item if it's at home in your dresser drawer when you need it!

Remember, before you can take it with you, you've got to make it. Don't wait—do it now!

Questions or comments concerning the information contained in this article may be directed to 3636 CCTW/DOTO, Fairchild AFB WA 99011, AUTOVON 352-5470. ★



HELICOPTE

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California Air National Guard

Traditionally, in-flight icing has been given only passing consideration as a limiting factor in helicopter operations. The underlying rationale for this philosophy was that icing is primarily a problem resulting from flight in instrument meteorological conditions (IMC). Since most helicopters were not capable of instrument flight, there was little justification for expending time and resources on this aspect of rotary wing flight.

Contemporary helicopters have deviated from the traditional role of operating only in visual meteorological conditions (VMC) and routinely perform under Instrument Flight Rules. It is this expansion of the helicopter's operating envelope that compels a more thorough understanding of the hazards associated with in-flight icing.

The risks associated with flight in sub-zero liquid precipitation or moisture have been known since the pioneering days of fixed wing flight. Typically, we have characterized icing problems by their effect on airplane performance, i.e., lift, drag, weight and thrust. It is readily accepted that in-flight icing reduces thrust and lift and increases drag and weight, all to the detriment of an airplane's performance.

Rotary wing aircraft also suffer from these effects and, in addition, are susceptible to various complications that are *not common* to fixed wing aircraft. These peculiarities are discussed below to acquaint helicopter operators with their importance and impact on aircraft performance.

Deterioration of Autorotational Qualities

The adverse effect of main rotor icing on autorotational performance has gone unnoticed until recent (1974) artificial and natural icing tests conducted by the US Army. A major finding of this research was that moderate ice accumulation (approximately one-half inch) on inboard portions of the UH-1H (Bell 205-1A) rotor blade, and similar aircraft, was sufficient to preclude a safe autorotation in the event of an engine failure.

This abnormality results from ice accumulation in greater amounts near the inner portions of the rotor disc, which directly affects the blade's efficiency with respect to upward airflows during autorotation. The reported result is that, with approximately one-half inch of ice on the main rotor blade's inner portion, minimum (safe) rotor rpm cannot be maintained during autorotation.

Pilots of rotary wing aircraft are cautioned not to judge or estimate main rotor blade ice accumulation by observed buildup on the windshield or other parts of the aircraft, since icing occurs at an accelerated rate on the rotor blade as compared to accumulation on the fuselage. A more reliable method for operators of UH-1 (Bell 205) type aircraft, is to estimate ice build up on the main rotor blades by monitoring power required (torque indications). Researchers indicate that blade icing of one-half inch or greater will be accompanied by a 5-6 PSI torque increase over the before or "no ice" power requirement.

Although similar testing has not been completed for all rotary wing aircraft, this phenomenon does not appear to be unique to the UH-1 (Bell 205) and deserves the attention and consideration of all helicopter operators.

Ice Shedding

Many rotary-wing operators are inclined to disregard the potential hazards of main rotor blade icing owing to the in-flight "shedding" of ice. In-flight shedding can and does occur; unfortunately, it is as likely to create a problem as it is to relieve one.

Symmetrical (affecting all rotor blades simultaneously in the same way) shedding in-flight can be beneficial by restoring the rotor blades to a more efficient or clean configuration and by reducing the weight of the aircraft. Asymmetrical shedding (affecting less than all of the main rotor blades) however, can create extremely severe vibrations, depending on the amount of ice discharged, rotor system and other factors.

The severity of vibrations resulting from asymmetrical shedding are generally a function of the unbalanced weight of the rotor system and, therefore, may be expected to be greater for semirigid (2-bladed) systems and 3-bladed fully articulated systems than those rotor systems employing four, five, or more main rotor blades.

ICING



In short, the severity of vibrations resulting from asymmetrical main rotor shedding can be extremely hazardous and operators can expect the vibration levels caused by asymmetrical shedding to decrease with an increase in the number of main rotor blades (for a constant rotor mass) since the imbalance represents a smaller percentage of the rotor mass. Conversely, vibration levels may be expected to be greater when asymmetrical shedding occurs on 2 and 3-bladed systems.

Ice shedding from the main or tail rotor can also produce problems apart from an unbalanced rotor system. Though documentation is less than authoritative, researchers have experienced and expressed a concern for structural or foreign object damage (FOD) to the helicopter's fuselage, rotors or engines resulting from rotor blade shedding. This particular hazard appears to be more threatening to large multi-engine aircraft (over 12,500 lbs) and especially tandem rotor systems.

Asymmetrical shedding can be minimized by avoiding static temperatures lower than −5 C. Research indicates that by operating in environments of −5 C or warmer, shedding will generally occur symmetrically. Tests of UH-1 (Bell 205) type aircraft suggests that by rapidly varying main rotor speed or entering autorotation, symmetrical shedding may be induced when static temperatures are −5 C or warmer. Collective and cyclic inputs were generally ineffective in producing symmetrical shedding and may result in asymmetrical shedding. *At temperatures below −5 C, it is not possible for the pilot to induce shedding.*

Visibility

Most helicopters are not equipped with windshield anti-icing systems and, therefore, a complete or substantial loss of forward visibility will normally occur following prolonged flight in icing conditions. Normal defogging systems are not capable of preventing this windshield build up; however, visibility usually remains clear through the side windows even in moderate icing.

Power & Control Limitations

Light helicopters such as the Hughes 500 (OH-6A), Bell Jet Ranger (OH-58A) and the Fairchild-Hiller 1100 are "ultra-sensitive" to in-flight icing. The limited power available and smaller control surface make this type of aircraft extremely susceptible to icing.

Flight tests in icing conditions indicate that light helicopters experience a *rapid* degradation in aerodynamic characteristics and handling qualities with a corresponding increase in vibration levels. These limitations are vividly illustrated by icing flight tests with a light turbine helicopter (OH-58A) in Ottawa where five test flights were conducted; one flight in the cloud was as short as 1 minute and the longest was only 7 minutes.

Ground Operations

As previously discussed, ice shedding from the main rotor blades can and does occur when rotor speed is rapidly changed. This, of course, occurs routinely at the termination of a flight when the aircraft is being shutdown.

Operators and ground personnel should be alert when recovering helicopters after flights in suspected icing conditions to ensure that ground personnel stay well clear to preclude an injury by ice which is being "shed" from the rotor blades during shutdown.

METEOROLOGICAL CONDITIONS CONDUCIVE TO ICING

Aviation weather education has oriented pilots to think of aircraft icing as a function of the following two atmospheric conditions that must prevail simultaneously:

1. Free air temperature at or below freezing (0° C), and
2. Supercooled visible liquid moisture or high humidity.

Though this explanation provides some insight into aircraft ice formation, it presents only a meager perspective of the icing environment for operators of rotary-wing aircraft.

The inherent limitations of rotary-wing aircraft (service ceiling, range, endurance, speed and power availability) and the previously discussed icing hazards require a more comprehensive understanding of in-flight icing conditions and their relationship to helicopter operations.

Research studies indicate that in-flight encounters with icing conditions occur most frequently in the vicinity of frontal zones. In addition to the threat of icing in frontal clouds, frontal systems also create the necessary conditions for in-flight icing "outside of clouds."

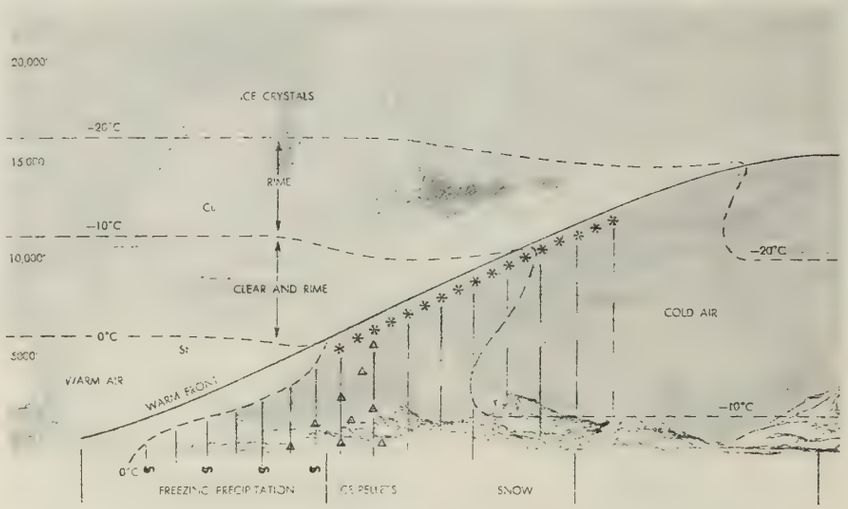


Fig. 1 Warm Front

Warm front icing may occur both below and above the frontal surface. Figure 1 illustrates how freezing rain or drizzle can be produced by precipitation falling through the front into the sub-freezing cold air below. As noted in Figure 1, this particular form of icing is most often found when the temperature above the frontal inversion is greater than 0° C and the temperature below is less than 0° C. Where temperatures above the frontal surface are subzero, ice pellets or snow may be noticed below the front and are normally not of concern to helicopter operators.

Icing in the clouds above the warm front's surface is characteristic of icing found in strataform and stratocumulus clouds and usually consists of rime or mixed rime and clear ice.

Cold front icing normally occurs in an area preceding and following the front (Figure 2). In this region, aircraft are likely to encounter the most intensive icing in clouds immediately above the frontal zone. Aircraft penetrating a cold front can expect clear icing to be prevalent in the system's clouds at the lower altitudes (0-15,000 ft MSL) and a mix of clear and rime ice at higher altitudes.

Freezing rain or drizzle may also be experienced in a "shallow" or "slow-moving" front where the warm air is lifted over the advancing cold front. This condition often produces clouds and precipitation well behind the surface position of the front. Upon falling through a subfreezing cold front, the rain becomes supercooled and freezes on impact with the aircraft.

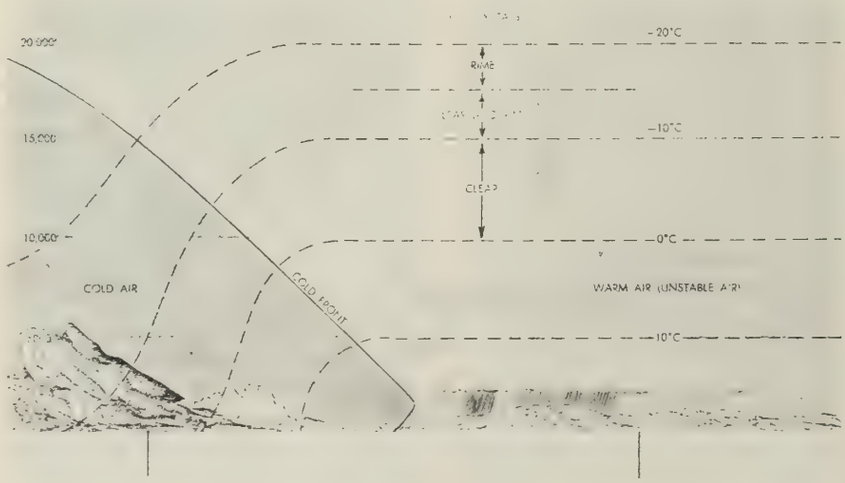


Fig. 2 Cold Front

Aircraft icing is more probable and severe over mountainous or steep terrain than over low or flat elevations. The presence of a mountain range causes strong upward air currents on its windward side which are capable of supporting larger than average water droplets and thereby compounding the icing hazard. The movement of a frontal system, with its companion turbulence and updrafts across a mountain range, combines the normal frontal lift with the upslope currents of the mountains to create an extremely hazardous environment for rotary wing aircraft.

The severest icing occurs above the crest and to the windward side of the ridges. This zone usually extends 4-5,000 feet above the mountain and can extend much higher when cumuliform clouds have developed.

ABOUT THE AUTHOR

Mr. Negrette is Deputy Director of Airports, Sacramento County, California, and a member of the California Air National Guard. He served as an Army helicopter pilot/operations officer in Europe, member of the Military Aviation Planning Board, Frankfurt, Germany, and as an Army aircraft commander/flight team leader in Vietnam where he logged 1,000 hours flight time in several different types of helicopters. He is a graduate of California State University and the Aviation Safety Officer Course, University of Southern California, with an M.S. in Transportation Engineering from University of California, Berkeley. ★

DISTRACTION

All of us have had some experience with distractions and most everyone encounters several types—pleasant, annoying, or whatever—in the course of a day. Although these changes in mood are typically short lived, they often produce disastrous and decidedly long term results. A headliner in this category is the distraction-induced aircraft accident.

One of the first jumbo airliner losses was largely due to the cockpit distraction associated with a landing gear indicator problem. While orbiting at low altitude to troubleshoot the system, the pilots became preoccupied with this task and failed to detect a gradual descent which culminated in a tragic accident and the loss of 101 lives. Darkness, sparsely settled terrain with few to no nighttime references all contributed but the basic cause was failure to maintain altitude control.

A few months later a military transport crew had a very similar accident, only in this case there was a cockpit discussion questioning the safety of a descent clearance which was issued just prior to the crash. The investigation disclosed that the ATC transmission was misunderstood and when the crew read back an altitude 2000 feet lower than assigned, their transmission was blocked and the controller was, therefore, unaware of the misunderstanding. Reportedly, the lights of the city were clearly visible ahead while the unlighted hills below were not. This hastened the end of the terrain clearance discussion and the dissenting crew member was assured everything was fine. A few seconds later the aircraft struck the ground and disintegrated. From the evidence available, it was concluded that a fully operational aircraft was flown into the ground by a highly qualified air crew simply because of insufficient attention to standard procedures and the distraction furnished by the lights of their destination. There was one survivor out of the 25 people on board.

In a more recent example, a night takeoff accident involving a tanker with a basic crew, there were no survivors available to report details but distraction was clearly evident, as the investigation showed. It was extremely cold and a series of ground delays added frustration to the already formidable discomfort of the crew. Shortly after lift-off they reported the landing gear wouldn't retract and requested a turn to downwind for a system checkout. The turn was never completed and it is doubtful if the aircraft even reached traffic pattern altitude. Contrary to longstanding procedures, and most probably as the result of undue attention to the gear problem, the flaps were brought up and the aircraft was flown into a power-on stall which terminated in a fiery crash. No evidence was found to indicate an in-flight causative factor other than inattention to basic pilot duties.

The experience levels of the pilots involved in these examples ranged from many thousands of hours to less than 1500 total hours so it can happen to anyone—anyone who will let it happen.—Courtesy *Flight Safety Focus,* November No. 7/76. ★

OPS TOPICS

VERTIGO

An Army UH-1 was to be repositioned late one evening. The weather was forecast to be 1,500 feet overcast and 3 miles with fog. On his first attempt, the pilot was unable to find the landing site in the darkness. On the second attempt, he spotted one of the aircraft on the ground and started a left descending turn for the approach. About 20 feet above the trees the Huey entered the clouds. The pilot tried to descend to VMC but ended up in an unusual attitude which gave him an extreme case of vertigo. He estimated that during the maneuver his airspeed exceeded 120 KIAS, and the aircraft reached an attitude of 65 degrees nose low and 70 degrees left bank. The aircraft broke out of the cloud just above the trees. However, the recovery resulted in a second unusual attitude when both pilots attempted recovery at the same time. Finally, everything got sorted out and the Huey made an instrument approach without further mishap.

PORTABLE BEACON

A lightweight, portable beacon to help military forward air controllers direct fighter-bomber missions close to the battle line is being designed by the Air Force Systems Command's Electronic Systems Division.

The new beacon transponder will be set up and activated by the forward air controller. When an approaching aircraft requires positional information, the weapons systems operator electronically queries the beacon. Precise location information is then displayed on his radar scope.

TROUBLE-SHOOTING = TROUBLE

Recently one of our fighter jocks experienced an engine malfunction which nearly became a major aircraft accident. While on a routine training flight, the pilot identified an unusual vibration which he investigated by cycling the air conditioning controls. Satisfied that the vibration was not coming from the cooling turbine, he proceeded with the mission. When the pilot noted poor throttle response during level-off at 30,000 feet, he declared an emergency and decided to conduct a series of engine troubleshooting exercises en route to his home base.

Descending to 12,000 feet, the pilot selected afterburner, deselected afterburner, selected afterburner again, but noted poor throttle response, so returned to normal power settings and landed from a precautionary pattern. During the precautionary pattern, the engine responded very slowly to throttle movement, and did not respond at all during landing rollout. The engine vibrated severely during shutdown.

During the past 60 years, logistics personnel have developed many different specialized tools and procedures to aid in engine troubleshooting and repair. Giving your maintainers a chance to use this equipment should be your goal whenever things start to act strangely.—Capt Gene Larcom, Directorate of Aerospace Safety.

CRASH DIET

A student pilot experienced hypoxia during a dual training mission. Medical evaluation led the flight surgeon to the conclusion that part of the student's problem was low blood sugar levels. The student had been on a self-imposed, unsupervised crash diet. This diet led to low blood sugar and the subsequent hypoxia symptoms. If you want to lose weight, the Flight Surgeon will be glad to help you with a proper diet.

OPS TOPICS

FAA CONVERTS ATC FIX CODES

AUDUBON has been changed to BIRDI, WOODS HOLE has become WORMY and APPLE SPRINGS now goes by the name of JUICE.

It may sound like a new word game. But, actually, the Federal Aviation Administration is changing to five-letter pronounceable codes the names of intersections and waypoints used for navigation in the national aviation system. And, while some of the new names may be less colorful than the old, FAA says they will make things much more efficient for air traffic control purposes.

Under the old system, the fixes—reporting points or airways intersections—often got their names from local topography or towns. Thus, there appeared on aeronautical charts such polysyllabic names as ALCATRAZ, BALD MOUNTAIN and NORTH NANTUCKET.

The problem was that chart names were different from the computer codes used in the semi-automated air traffic control system.

In the new system, the charting name and computer code will be the same. Chart clutter will be reduced with the shorter names, yet the five-letter combination will allow enough unique combinations to accommodate a non-repetitive worldwide coding system.

INADEQUATE COCKPIT FOD INSPECTION

An F-4 pilot recently took off and discovered the stick would not move to the right when he attempted to turn out of traffic. The aircraft was safely recovered through the skillful use of rudder and good pilot technique. A compass mode selector knob had lodged in the lateral control stop mechanism under the front cockpit torque tube shield. There was an aircrew entry in the aircraft records noting the knob was missing 15 days earlier, but the cockpit FOD inspection failed to locate it. If an object is believed to have been lost in the cockpit, an intensive search should be conducted until it is found.—Col Warren J. Hunt, Directorate of Aerospace Safety

A SLIGHT MISUNDER-STANDING

The aircrew had come to the depot to pick up a C-130. On the day before the mishap the crew had tried unsuccessfully to launch, and then had reentered crew rest. The next morning the crew found that the Dash Six preflight had expired. At this time the crew was informed that they would have to perform the preflight themselves since the base had a policy of not accomplishing further preflights once a crew had accepted an aircraft. The crew mistakenly assumed that this meant they would have no support for launch and so proceeded to preflight and launch without assistance. The loadmaster was assigned to serve as fireguard and outside observer during start. After the engines were started the loadmaster moved the AGE, cleared the area and told the pilot he was clear to taxi. As the aircraft pulled out of the chocks, it struck a fire extinguisher that had been overlooked after engine start. During the launch a very heavy rain was falling which reduced visibility and obviously made it very difficult for the loadmaster to be truly observant. Fortunately, there was only minor sheet metal damage. Had the item struck been a workstand or power cart the results would have been more serious ★



DESIGNED TO CRASH

MAJOR ROBERT W. SWEGINNIS
Directorate of Aerospace Safety

So long as man continues to fly, he will continue to crash.
Anon.

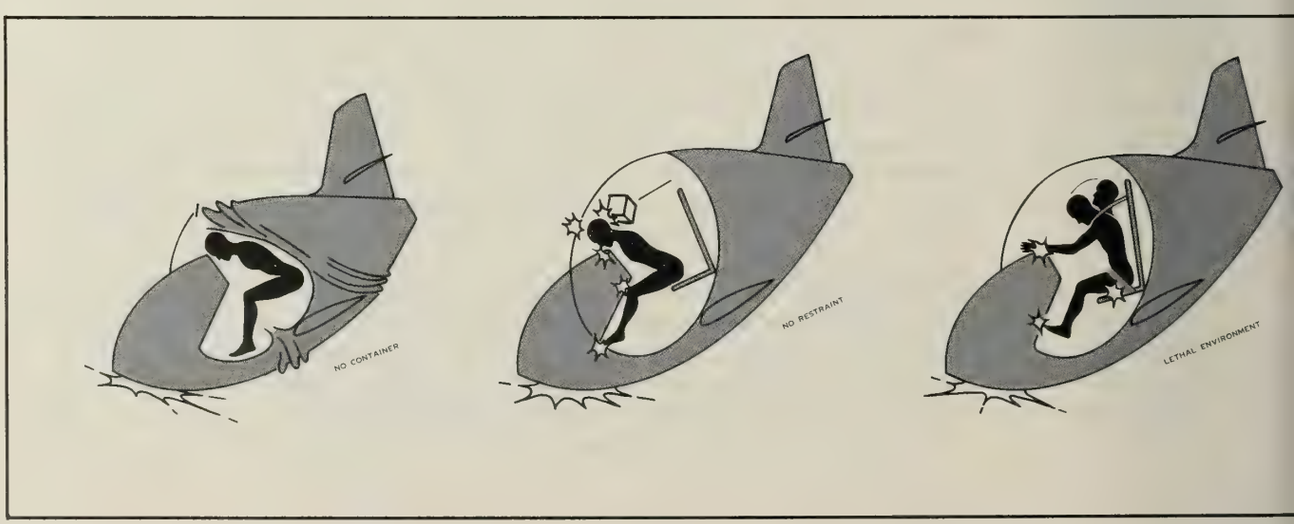
Despite advances in system and flight safety techniques and enforcement, flying remains an intrinsically hazardous operation. Human error, be it pilot, maintenance technician, designer, or whomever, can and will continue to haunt us. So why not plan for the inevitable?

Why not recognize, while the design is still transitioning from between the ears to the drawing board, that things will go wrong? The big iron bird will take to running through the weeds, with the pilot and other folks, all passengers in that somewhat undefined event called a crash.

We have come a long way since Lt Selfridge became the first of a long list of statistics; 40 g cockpits, restraint systems for crew, passengers, and cargo, and crash helmets. But losses remain. Many are avoidable. One recent study* indicates that from 1967 through

**USAF Experience in Aircraft Survivability by Maj Warren D. Tuttle, presented at the Aircraft Crashworthiness Symposium, 6 Oct 75.*

Drawings below illustrate factors controlling chances of crew/passenger survival during a crash. First four related to the crash itself, while "post crash" factor relates to fire, injuries, escape routes, etc.



1974 the USAF experienced 224 cargo/transport aircraft accident fatalities. Over 80% of the fatalities were reported to have occurred in potentially survivable crashes.** What can be done to reduce the losses?

In the late 60s and early 70s, the US Army launched a series of studies to examine the chances of crew/passenger survival during helicopter and light fixed wing aircraft crashes. Short term results of these efforts have been amazing. A crashworthy fuel system retrofitted into Army UH-1 aircraft has all but eliminated thermal induced fatalities and injuries. The long term effects of these studies are now coming to light and may be even more spectacular. In addition to fuel systems which resist rupture, puncture, and tearing, seats and restraints have been designed to significantly minimize crew/passenger injury due to "g" loads. Review of helicopter crash dynamics has also resulted in designs which are highly crash resistant. Prototype designs have lived to fly away from crunches which would have "class 26ed" any of our current generation choppers.

U.S. Army Helicopter Experience
Apr 70 - Jan 76

	Crashworthy Fuel System	Non-Crashworthy Fuel System
Mishaps	1,290	1,221
Post-Crash Fires	34	85
Thermal Injuries	5	25
Non-Thermal Injuries	414	542
Thermal Fatalities	1*	65
Non-Thermal Fatalities	130	349

*This fatality was involved in a non-survivable crash

What does this mean to us blue suited, fixed wing pilots? It can mean a whole lot. Our nap of the earth friends have shown that the technology exists to improve our chances when we drive it through the weeds or try to pound the struts through the wings. They have also developed a systematic approach toward developing a crashworthy design by identifying and quantifying design requirements and features.

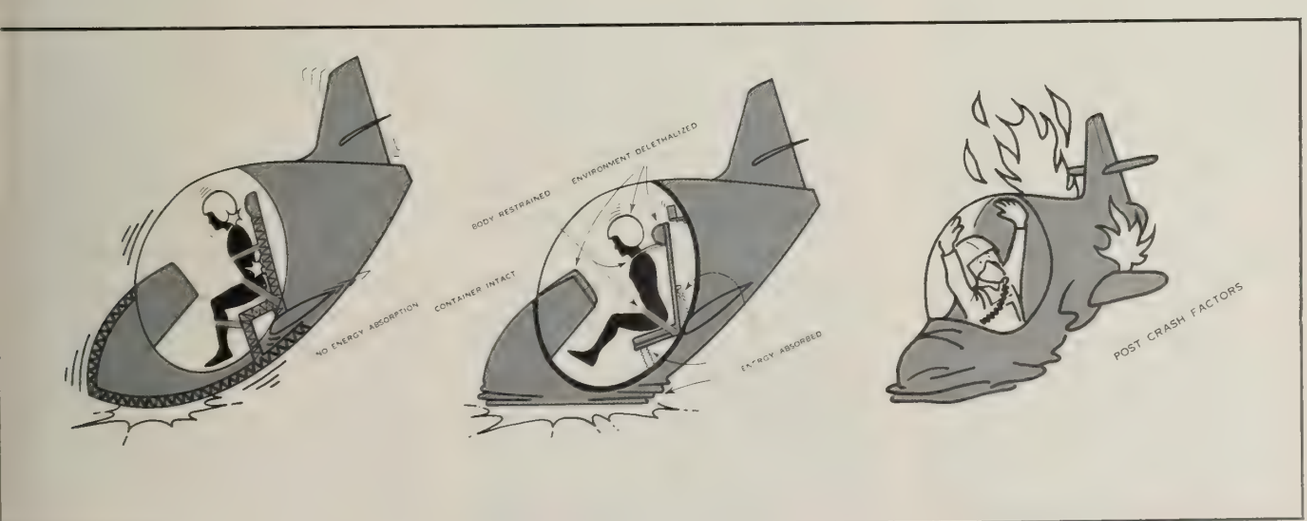
The Crash Survival Investigator's School at the University of Arizona has identified five factors which control the chances of crew/passenger survival during a crash. The acronym for these factors is CREEP.

C—container
R—restraint
E—environment
E—energy absorption
P—post-crash factors

The first four factors relate to the dynamic situation of the crash itself, the initial and subsequent impacts and deceleration forces until the aircraft comes to a halt. The last factor relates to what happens to the occupants after the metal stops sliding. A brief explanation of each of these factors follows.

Container In order to survive a crash, it is first necssary to provide livable space for the occupants. If this space is crushed or punctured, the chances of survival fall drastically. It didn't take long for the founders of the flying services to realize that a 40 g cockpit was a highly desirable feature.

**A survivability crash is defined by the Arizona State University, Crash Survival Investigator's School as a crash in which survivable space existed throughout the crash sequence and "g" loads applied to the occupant(s) did not exceed tolerance limits.*



Lindy had all the heavy stuff in front of him (engine and fuel) so that if he had to make a very sudden stop he wouldn't become the meat in an aluminum and steel sandwich. Today we can predict how and where the aircraft structure will fail during survivable crashes. Crew, passengers and critical systems can be located to maximize survival.

Restraint After we provide the travelers with their living space, they should be kept from:

1. Banging against the sides of this space or objects within it.

2. Having other objects (e.g., cargo, equipment) bang into them. The strength of all restraints should be sufficient to prevent injury at the force levels which can be expected during the most severe, but survivable, crash.

Environment We have now built a box around our occupant and glued his butt and maybe shoulders to it. However, we can't expect to fully restrain the motion of head and limbs. The volume through which the unrestrained extremities can be expected to move must be delethalized as much as possible. Either move the obstructions or pad them. In addition, energy absorbing devices can be used to attenuate the "g" forces transmitted from the airframe to the restraint systems. Since the body is not rigidly attached to the airframe, the acceleration forces experienced by the body may be either amplified or attenuated. A soft, deep seat cushion (elastic) can greatly amplify vertical "g" forces. Similarly, a deep seat cushion that deforms only at higher than normal loads (energy absorbing) can greatly reduce the deceleration forces experienced by the body.

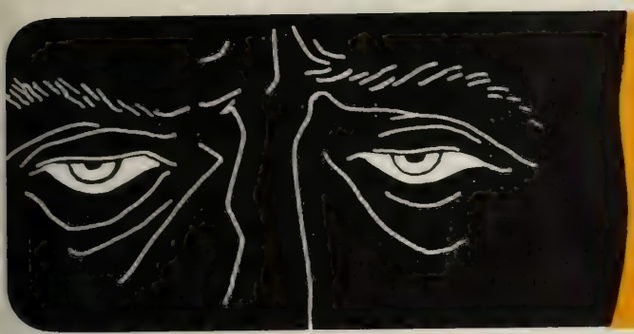
Energy Absorption Did you ever jump off the porch steps stiff legged and flat footed? Quite a jolt. Just as flexing our legs and feet cushion a landing from a jump, flexing (but not breaking) structure can cushion crash loads. If energy absorbing structure exists between you and the impact, your chances of survival are increased. This crushable structure not only reduces the decelerative forces it would experience, but it also tends to protect your container from being penetrated during the same impact conditions.

Post-crash Factors Fire, injuries, confusion, escape routes, aircraft damage, visibility. Fire is the most important of the post-crash factors. Over 75% of otherwise survivable aircraft accident deaths have been attributed to post-crash fire. Not only can fire kill directly through heat and toxic fumes, but it initiates and compounds the severity of all the other factors. Control of fire, therefore, is a key issue in aircrew survival. Until someone comes up with a fuel that won't burn in the open air (and people are working on it), the most effective means of preventing fire is to contain all fuels and flammable fluids. Intelligent designs can place lines and containers in the least vulnerable locations so that a structure which is expected to collapse or fail during a crash will not cause spillage. Fuel tanks, however, are so large that they most often cannot be "hidden" within the structure.

Because of the high energy exchanges occurring during the crash, only fuel tanks which can withstand extensive deformation without rupture and tearing can be expected to maintain their integrity. When these "crashworthy" tanks fail, the breach tends to be small and nonpropagating. When noncrashworthy tanks fail, they tend to rupture and release large volumes of fuel in a highly volatile mist or cloud. Ignition sources during or just after the crash sequence can initiate an intense flash fire or fireball which provides sufficient heat energy to ignite materials which then sustain the fire.

The US Army has sponsored the development of fuel systems which are capable of withstanding high impact forces without significant fuel spillage. These systems utilize tough tear and penetration resistant fuel tanks, self-sealing breakaway fuel lines, and other design features which eliminate or minimize leak producing damage to the fuel system. The FAA has also successfully tested a full-scale DC-7 crashworthy fuel system. The tests indicated that fuel systems incorporating crash actuated valves and crash-resistant bladder material were effective in minimizing the hazard of post-crash fire in survivable crashes.

Use of crash-resistant fuel systems has not yet been accepted as universally cost effective. However, it should be considered in any system required to carry a large number of people or in which rapid evacuation during a crash could be a problem. The cost of crew members and passengers killed or disabled in post-crash fires should be seriously weighed against acquisition costs and performance penalties. Many of the other concepts discussed in this article can be incorporated in future designs at little or no additional cost. Designers and system managers need to realize that each new design, sooner or later, will crash. Let's design them to maximize survival during that crash. ★



FLIGHT CREW FATIGUE

CAPTAIN H. J. BERGEN, Canadian Air Line Pilots Association, Courtesy CALPA Pilot

When discussing fatigue and its effect on an aircrew, it would be wise to define exactly what is being discussed. Perhaps the best definition that comes to mind is the one in the USAF Flight Surgeon's Manual, which states:

"Fatigue is that detrimental alteration or decrease in skilled performance related to duration or repetitive use of that skill, aggravated by physical, physiological or psychic stress."

WHAT IS FATIGUE?

Fatigue can manifest itself in basically two forms—acute fatigue and chronic fatigue.

Acute fatigue is the feeling familiar to all of us after a long flight or during repeated short flights. It normally disappears after adequate rest.

Chronic fatigue is caused by two separate and distinct sets of factors:

The difficulty, the duration and the frequency of flying; and

The duration and effectiveness of rest between flights for rehabilitation of the organism.

Chronic fatigue can be best described as a cumulative phenomenon resulting when physical and mental recuperation has been incomplete.

FACTORS CAUSING FATIGUE

- Upsets in the human metabolic clock during night flying or time zone crossing.
- Visual difficulties of the human organism at high altitude due to glare, empty visual field, and hypoxia.
- Hypoxia, or lack of adequate oxygen in the blood, which is the result of working for prolonged periods at high altitudes.
- Noise and vibration in the cockpit environment.
- The so-called "exotic" problems peculiar to working pilots, such as the effects of ozone, less screening of the sun's radiation with consequent increase in radiation exposure.
- Humidity and temperature extremes, both in the cockpit and at layover points.
- Workload both in the individual duty cycle and over the complete month.
- Miscellaneous factors contributing to the onset of fatigue, such as (a) Responsibility to crew, passengers and airline; (b) Apprehension of a particular flight; (c) Poor teamwork or actual crew conflict in the cockpit; (d) Personal inadequacies, both real and imagined and/or lack of adequate training; (e) Personal problems such as financial, family, etc. (in other words, "mind not on the job"); (f) Hangovers; and (g) Pain and/or illness of a temporary nature. (This report will not delve into the above because, while they should be considered in the context of pilot fatigue, they are of a more or less personal nature.)

DETAILED EXAMINATION OF FACTORS CAUSING FATIGUE

One of the adaptations man has made to survive on the planet Earth has been to establish a "metabolic clock" which regulates such things as body temperature, volume of blood circulation, oxygen consumption, rate of metabolism, and even the replacement rate of cell tissue.

All of these variations of the human organism normally repeat themselves with clock-like regularity within a temporal frame of 24 hours. The most easily recognized variation is body temperature. Man's temperature generally reaches its maximum in the late afternoon and minimum in the early morning.

Now, superimpose this metabolic rhythm on night flying or trans-oceanic flying and what occurs? A pilot doing a trans-oceanic flight would normally get up some time in the morning of the departure day. He would possibly try to obtain additional rest immediately before departure (about the time his metabolic clock has his body running at its peak). At about the time he would normally retire he boards the aircraft to begin a 12-hour duty period. He then has to cope with an increasingly complex workload while his metabolic clock is decreasing the efficiency of his body. At about the time his body has reached its low point in performance, he is called upon to accomplish the approach and landing in a

FLIGHT CREW FATIGUE continued

relatively strange airport with possible weather, language and other problems complicating his life.

To a person on the surface of the planet Earth, his world consists of a bright topside and a relatively dark bottomside. The contours of his face cater to this, shielding him from the bright topside with eyebrows and the bony ridges above his eyes. However, to the pilot in an aircraft at altitude, his world is reversed. The bottom is the bright side and the top is the relatively dark side. He thus has no natural defenses against the glare he is being subjected to.

Another factor contributing to eye fatigue is the contrast between a relatively bright outside and a dark cockpit. The pilot's eyes are not able to adjust back and forth from high light level to low light level.

Empty Visual Field can best be described as the inability to focus on infinity. The human eye will normally focus on a point about 3½ feet from the eye. At altitude, it becomes necessary to consciously focus on an external object, such as the horizon or clouds, to provide any sort of external scan for traffic.

A leading medical authority has stated: "The visual system . . . is particularly sensitive to lack of oxygen, and a lack of oxygen not sufficiently severe to be classed as anoxia may yet produce some effects upon it. Thus in night vision at as low an altitude as 4,000 feet, the effects of lack of oxygen manifest themselves in the failure to attain the lowest threshold of dark adaptation possible under optimum conditions." An aircraft with a cabin altitude of 5,000 feet is certainly affecting the occupants, particularly in night vision adaptation.

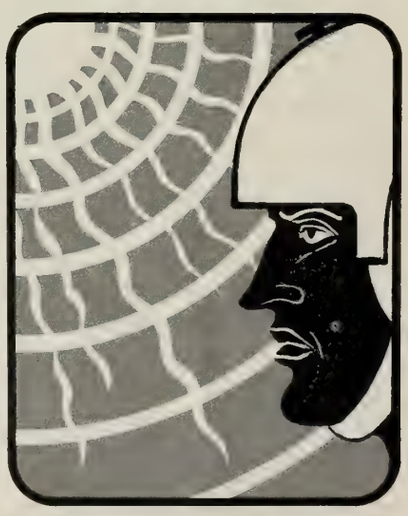
In addition to the previously stated impairment of night vision, the onset of subtle hypoxia, such as would occur at pressure altitudes above 5,000 feet, has been proven to interfere with the higher intellectual functions, e.g., complex decision-making.

How does subtle hypoxia affect fatigue in the aircrew member? The answer is quite obvious, since it has been well established that fatigue occurs more rapidly in an oxygen-deficient system; the muscle concentrations of lactic acid (a sign of muscular fatigue) build up with continued stimulation of the muscle, and this product is found only where there is a relative unavailability of oxygen.

When cigarette smoking is added to the above, a totally different and vastly more serious picture emerges. Since smoking interferes with the body's ability to obtain oxygen from the air and eliminate carbon dioxide, very often the apparent altitude of the cockpit to the smoker is above 10,000 feet. The increase in subtle hypoxia, with all its complications for the smoker, then becomes a very significant factor in his fatigue level.

On the subject of noise, an excerpt from the U.S. Flight Surgeon's Manual will suffice:

"Of the more general effects of noise, the most universal is a feeling of excessive fatigue at the end of exposure. This feeling is out of proportion to the fatigue that could be expected from similar work under more quiet circumstances. This effect has been noted by both flyers and ground crewmen to be greater in proportion to the noise volume. For the flyers, it appears likely that a portion of the fatigue can be attributed to the necessity of pay-



ing strict attention to radio signals, especially during instrument flight. There is then a psychological strain involved in listening."

Vibration in the frequency range of 18 to 1500 cycles per second has a perceptible effect not only on the skin of the human body, but on some of the deeper structures of the body. The general result of the above vibrations depends on their direction in relation to the axis of the body, the conductivity of the body tissues and the area of the body in contact with the vibrating surface.

The exotic problems affecting the working pilot, while possibly a significant factor, have not been documented to anyone's satisfaction. Therefore, ozone, increased radiation, etc., will be left to a paper of greater scope.

Statistically, pilots live within 1,000 feet of sea level with a humidity level of from 25% to 75%. During their working periods however, the humidity level varies from the almost negative level encountered in the aircraft at altitude to the 100% level encountered during layovers in some regions of the world. Not only the rapid change in humidity, but the dehydrating effects of very low humidity have a very fatiguing effect, and although the conditions do not have that great an effect on passengers, the cumulative effect of this problem over a series of flights results in a significant level of both acute and chronic fatigue in pilots.

While temperature variations also have a bearing on the fatigue level of individual pilots, the level of fatigue induced is not usually as great.

The workload the pilot is subjected to has a great bearing on the fatigue level induced, but since this falls considerably outside the scope of aeromedical problems, this will be left to a more appropriate agency.

METHODS OF ALLEVIATING FACTORS CAUSING FATIGUE

Several magazines have published articles counseling travelers on how to adapt to changes or upsets to their metabolic clock. Unfortunately, very few of these remedies apply to the average pilot who has to cross and recross a number of time zones several times a month. Reserve pilots work a day-night split of their flying that allows no stabilization of their metabolic clock.

Pilots should try, as far as possible, to keep the physiological day-night cycle corresponding to their home base, or make every effort to keep the frequency of a phase shift within permissible limits. They should ensure their meals are taken as close to the home base normal time as possible, their elimination schedule should conform to their normal times, etc. The crew accommodations should be of the highest quality—quiet, comfortable, restful, and able to be darkened. The crew should be aware of the diurnal rhythm of their metabolic clock and realize that there are going to be some times when their efficiency will not be as good as others, so as to maintain increased alertness during these periods.



The addition of a good, well-fitting pair of sunglasses on a pilot's nose during periods of glare is probably the best tool in combating the increased light levels encountered at altitude. Aircraft sun shields should also be used.

Maintaining approximately equal light levels between the outside environment and the interior of the cockpit, particularly the instrument panel, normally alleviates the fatigue induced by contrasting light levels.

Empty visual fields are one of the areas where no immediate fix is indicated. Possibly, some of the air-



FLIGHT CREW FATIGUE

continued



craft collision avoidance systems now under development will permit decreased scanning levels in the future, but at the present time the best tool available to a pilot for aircraft avoidance is an alert and systematic outside scan technique.

Subtle hypoxia can be partially combated by occasionally resorting to the oxygen mask, undesirable as this is. A better fix consists of climbing out of the aircraft seat approximately once every hour, stretching, yawning, moving around, etc. This stimulates the body to increase the intake of oxygen, for muscular contractions increase the circulation of the body and, in turn, result in an increased supply of oxygen to the muscles and a decrease in the level of lactic acid in the muscles. Altogether, the advantages of a good stretch cannot be overstated.

Smoking, while under the direct control of the smoker, not only impairs the smoker but decreases the available oxygen of the other crew members. For this reason alone, and ignoring the other factors affecting this highly emotional issue, smoking should be banned in cockpits with altitudes over 3,000 feet. Recognizing the impossibility of this, a better answer might be to limit the smoking to a certain level and increase the airflow over the smoker.

Other than increasing the soundproofing of aircraft, obtaining radio headsets that screen external noise, and increasing the quality of radios, not much can be done about the noise we are subjected to. Unfortunately, the average pilot works in a fairly noisy environment.

Vibration, on the other hand, can be much alleviated by the design of the cockpit seat, carpets on the cockpit floors, eliminating contact with vibrating surfaces, etc. An incidental benefit of a properly designed pilot's seat is the elimination of the back problems so many pilots are subjected to.

Low humidity levels in the aircraft can be partially alleviated by proper intake levels of fluids before, during and after the flight. Avoidance of the perennial favorites of the flight deck, coffee and tea, reduces the level of urine produced during a flight. Approximately 8 ounces of fluid every 30 minutes is required to maintain the proper liquid level of the human body during the average flight.

High humidity levels, like high temperature levels, usually occur at layover points. Crew accommodations should provide normal levels in the hotel rooms used by pilots.

SUMMARY

When considered dispassionately, the profession of airline pilot is surely one of the most improbable methods of earning a living there is. The pilot encases himself in an aluminum tube with a bunch of other damn fools, goes hurtling down a two-mile strip of asphalt, praying that a little-understood rule known as Bernoulli's Principle will continue to apply, vaults into the air, spends anywhere up to ten hours in a completely hostile environment consisting of partially compressed air with no moisture present, too much light, not enough oxygen, unable to remain at a high efficiency and mental alertness level, and is then expected to take this monstrous metal tube and graze the ground gently with it. No wonder the phenomenon known as Flight Crew Fatigue occurs. ★

ABOUT THE AUTHOR

Captain Bergen has been a pilot with Air Canada for 11 years. His interest in pilot fatigue and physical fitness was sparked when he observed that his sedentary airline job was more tiring as well as less inducive to fitness than his previous physically strenuous job as a bush pilot. Captain Bergen has worked closely with the Fitness Institute in Toronto and is aeromedical chairman for the 650 Air Canada pilots based in Brampton, Ontario, Canada.

DAYDREAMS AND IMAGINATION

CAPTAIN GENE LARCOM
Directorate of Aerospace Safety

Historically, preflight planning has been a problem of major proportions. As pilots ventured far from the aerodrome in their fragile machines of wood, wire and fabric, they stretched the capability of their preflight planning. With no radio, no NOTAMS, no flight service, reliable weather reporting or forecasting, the standard items we include in our planning were missing. A road map, the words of fellow pilots who had been there before, and a generous amount of luck allowed a few of those original aviators to reach old age.

Coupled with almost total ignorance about the world beyond the horizon was the pilot's own imperfect understanding of how his machine operated and why it flew. He depended on his imagination to supply the missing facts. The accident rate in early aviation was correspondingly very high. That it wasn't 100 percent is a tribute to the courageous pilots who were pitting their imperfect skills against the unknown.

During the nearly three score years of military aviation experience, we have come a long way in expanding our horizons. Radio aids to navigation, FLIP, air-ground radio communications, weather reporting and forecasting allow us to evaluate all the pertinent factors during preflight planning. We no longer have to guess at what is beyond the horizon. Instead of using only an active imagination to mentally picture the cow pasture or wheat field on the edge of the next town, we have an oblong paperbound book with numbers and symbols and codes to give us runway length, width, orientation, weight-bearing capacity, crown, slope, and even the material of which it is constructed. The obstructions are listed, the fuels and service available, the operating hours and the radio frequencies. All of this would have boggled the mind of the early aviator, and I think it boggles the mind of many pilots today.

Have we as pilots matched the progress that has been made in other areas of aviation? We must still apply imagination to those numbers to produce a mental picture of where we are going. The hazards associated with those numbers are different from the hazards associated with the wheat field or cow pasture but unless we prepare for and avoid them, there is a good chance of becoming one of the numbers on an accident summary. There is still a place in aviation planning for a vivid imagination. ★



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MINOT AFB	Minot, ND
LORING AFB	Limestone, ME
McCLELLAN AFB	Sacramento, CA
MAXWELL AFB	Montgomery. AL
SCOTT AFB	Belleville, IL
McCHORD AFB	Tacoma, WA
MYRTLE BEACH AFB	Myrtle Beach, SC
EGLIN AFB	Valparaiso, FL
MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
MARCH AFB	Riverside, CA
GRISSOM AFB	Peru, IN
CANNON AFB	Clovis, NM
LUKE AFB	Phoenix, AZ
RANDOLPH AFB	San Antonio, TX
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HILL AFB	Ogden, UT
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, NC
ENGLAND AFB	Alexandria, LA
KADENA AB	Okinawa
ELMENDORF AFB	Anchorage, AL
PETERSON FIELD	Colorado Springs, C
RAMSTEIN AB	Germany
SHAW AFB	Sumter, SC
LITTLE ROCK AFB	Jacksonville, AR
TORREJON AB	Spain
TYNDALL AFB	Panama City, FL
OFFUTT AFB	Omaha, NE
McCONNELL AFB	Wichita, KS
NORTON AFB	San Bernardino, CA
BARKSDALE AFB	Shreveport, LA
KIRTLAND AFB	Albuquerque; NM
BUCKLEY ANG BASE	Aurora, CO
RICHARDS-GEBAUR AFB	Grandview, MO
RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH
CARSWELL AFB	Ft. Worth, TX
HOMESTEAD AFB	Homestead, FL
POPE AFB	Fayetteville, NC
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KI SAWYER AFB	Gwinn, MI
REESE AFB	Lubbock, TX
VANCE AFB	Enid, OK

mail call

Send your comments and questions to:
Editor, Aerospace Safety Magazine
AFISC/SEDA
Norton AFB, CA 92409

ALTITUDE REPORTS

1. Air Traffic Controllers **are** required to verify altitudes both in enroute and terminal air traffic control environments. (See FAA Handbook 7110.65 Section 5 Altitude Verification and Position Reports.)

2. Your article "Be Where You Say You Are" December 1976, **Aerospace Safety** magazine does provide a good lesson to be learned in regard to altitude reporting from a pilot's viewpoint but is positively incorrect in regard to air traffic control regulations and procedures.

3. A great deal of emphasis has been placed on altitude verification from the controller's side of the picture in the last few years. To make a concise statement that controllers do not ask for altitude reports unless a possible conflict exists, does not present an accurate nor reasonable assessment of the real situation.

RODNEY J. JAGO, Major, USAF
Chief, Air Traffic Control Branch
Air Force Section—Armish MAAG
Box 500
APO New York 09205

You're right—what we should have said is, "Air Traffic Controllers do not question an altitude report without a good reason." The point of the article is: Pilots must accurately report altitudes because the controllers expect it and base decisions on the reported altitudes.—Ed.

WHAT'S A CUBIT?

The November issue (76) stirred my curiosity about the "CUBIT." An engineer by training, I am quite used to the metric system and "inch-system", but old Egyptian measures are not commonly used these days.

So here is what I found and maybe some readers care to read about it.

The cubit was the standard unit of length-measure in ancient Egypt and the coast from Alexandria to Tyre at about 2600 B.C. The biggest ships built in those days measured about 100 cubits, being equal to 45 m. This, in turn, defines a cubit as ½ yard or 1½ feet. Old drawings show that those ships were rather oversized canoes and only fit for coastal operations. I do not know until what time the cubit remained a standard measure.

HANS E. JENNY
Assistant to the General Manager
Aircraft Maintenance and Overhaul
Swiss Air Transport Co, Ltd
Zurich-Airport

WE'RE GOING WHERE?

1. Reference **Aerospace Safety** magazine, Volume 33, January 1977, article "We're Going Where?"

2. The photograph depicting Runway 21 at Kirtland (on page 20) must have been printed wrong. Albuquerque International runway depiction on page 21 shows that Kirtland Runway 21 does not have a perpendicularly crossing runway as indicated in the photo on page 20. In addition, the mountains look similar to the Sandia Mountains, but the Sandias are NE, not SW, of Kirtland. I hope the AQP package doesn't also have the wrong depiction for Kirtland AFB.

RICHARD C. BAIR, Major, USAF
Staff Scientist, AFWL/IN
Kirtland AFB, NM

No, the AQP package is right, we just forgot where we were. The picture we published was City of Colorado Springs Municipal, not Albuquerque International. The two airports are shown correctly below. —Ed.



Runway 26 Albuquerque International

City of Colorado Springs Municipal, CO.





NAME THAT PLANE

This fighter interceptor designed for point defense had both turbojet and rocket engines. (For answer see inside front cover.)

☆U.S. GOVERNMENT PRINTING OFFICE 1977 789/855/43

ITED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.





CAPTAIN

Dean R. Rush

2020th Communications Squadron

CAPTAIN

Donald A. Blasberg

363d Supply Squadron

Shaw Air Force Base, South Carolina*

On 10 July 1976, Captain Rush, aircraft commander, and Captain Blasberg, copilot, were on an airlift mission in a T-39 transporting three passengers from Bergstrom AFB, Texas, to Langley AFB, Virginia. During an en route descent, at 3000 feet 15 miles southwest of Langley, the right engine fire warning light illuminated and Captain Rush noted engine rpm decreasing rapidly. Following flight manual procedures, he immediately reduced power on the right engine, and, when the fire warning light remained on, shut down the engine. Captain Blasberg pulled the right engine T-handle and then activated the engine fire extinguisher. The right engine fire warning light still remained on. Before the crew had time to assess the situation further, the left engine fire warning light illuminated with an accompanying violent fuel flow fluctuation. Captain Rush reduced power on the left engine to 70 percent. The fire warning light went out and the fuel flow fluctuation ceased. Captain Blasberg notified Norfolk Approach Control of the critical emergency and received clearance to land against traffic at Langley. Captain Rush flew a straight-in visual approach to Runway 7, lowered landing gear and flaps on short final, and completed a successful, reduced thrust, single-engine landing. The professional competence and prompt reactions of Captains Rush and Blasberg to a serious emergency not only prevented the loss of a valuable aircraft, but also possibly saved the lives of the passengers and crew. WELL DONE! ★

*Note: Attached to Det 2, 1402 MAS for flying.

THE DIRECTORATE OF AEROSPACE SAFETY PROUDLY ANNOUNCES THE

USAF SAFETY TROPHIES

FOR DISTINGUISHED CONTRIBUTIONS DURING 1976



Secretary of the Air Force

SAFETY TROPHY

For outstanding achievement in accident prevention. Presented to the MAJCOM with the best overall accident prevention program in all safety functional areas.

UNITED STATES AIR FORCES IN EUROPE

Best overall accident prevention program of all commands that flew 2% or more of the total US Air Force flying hours during 1976.

The number of aircraft accidents, aircraft destroyed, and the major aircraft accident rate were the lowest in the history of the command, while the number of aircraft fatalities was the lowest in the past 5 years. USAFE did not experience a major explosives accident, missile accident, or a single nuclear incident, which further attests to the command's professionalism and motivation.

AIR FORCE LOGISTICS COMMAND

Best overall accident prevention program of all commands that flew less than 2% of the total US Air Force flying hours during 1976.

For the first time in its 30-year history, AFLC did not have a single aircraft accident. No major explosives or missile accidents were experienced, and ground fatalities were reduced to an all-time command low.



Presented to the major command with the most effective aircraft accident prevention program for 1976.

MAJOR GENERAL

Benjamin D. Foulois

MEMORIAL AWARD

AIR NATIONAL GUARD

The Air National Guard experienced the lowest major aircraft accident rate in its history, continuing a trend from the previous low rate in 1975. Also attesting to the effectiveness of its aircraft accident prevention program was the reduction in the number of minor aircraft accidents and aircraft destroyed, while flying nearly 400,000 hours, and operating 18 different weapon systems in a number of highly diversified missions.

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The SLUF In A Different Sky



UNITED STATES AIR FORCE

APRIL 1977

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THE MISSION - - - - - - SAFELY!

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LT GEN JOHN P. FLYNN
The Inspector General, USAF

MAJ GEN RANALD T. ADAMS, JR
Commander, Air Force Inspection and Safety Center

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Editorial Assistant

DAVID C. BAER
Art Editor

MSGT MICHAEL T. KEEFE
Staff Photographer

NAME THAT PLANE ANSWER

These are two (one pusher and later a tractor) versions of the first flying wing. The aircraft was designed with two cockpits offset from the centerline engine. The aircraft was usually flown from the left cockpit, while the starboard opening was faired over. The landing gear by the way was a reversed tricycle type. The pictures and information for Name That Plane courtesy Northrop Corp Aircraft Div.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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APRIL 1977 AFRP 127-2 VOLUME 33 NUMBER 4



CAPTAIN GARY A. VOELLGER
523 TFS
CANNON AFB, NM

During my eight years in TAC I've heard much said and seen a great deal written about what a fighter pilot is. *In general, the theme has been that a "fighter pilot" is more an attitude than an occupation; a proposition I can readily endorse. I would further propose that the single most essential element of attitude that distinguishes the "fighter pilot" from the "shoe clerk" is his standards.*

As members of the Air Force, each of us is familiar with the standards that are imposed by directives. They are not, however, the topic of this discussion. I am more concerned with those standards that each of us —F-15 pilot, crew chief, or supply officer—must individually define for ourselves and jointly define in our associations. We've all heard the wag discussing the individual who consistently sets low standards and fails to meet them. While the witticism is entertaining, it also contains an element of sagicity. Low, easily attained standards have an inherent debility. They breed contempt. Standards held in such disdain receive little attention, which often results in the deterioration of existing performance. Reciprocally, the individual who sets high standards is stimulated to greater levels of performance by the challenge of those elevated standards. The obvious contrast in these two philosophies is in performance. The striver is ever improving, whether he attains his goal or not. The individual satisfied by mediocrity, remains static or even regresses.

This distinction in the setting of standards applies to groups as well as individuals. The establishment of high group standards brings in another dimension, though. The individual working toward elevated standards can accept falling short of his goal, consoled by the fact that he is improving all the time. My experience has shown that it is much more difficult for individuals to react to group standards with the same assurance, no matter how demanding the standards. As a result, groups tend to set standards that even the poorest performer can attain. The biggest contributor to this tendency is the misconception that we are helping each other. I say misconception because the lowering of group standards, like individual standards, more often than not has a negative impact on performance. And that helps no one.

Countering this tendency is a three-step process. First, we must be willing to set high standards, particularly as supervisors. Second, we must communicate that our expectations are high. Third, we must recognize that the benefit of such standards is derived more from the striving to meet such elevated goals than from their actual attainment.

As an example of this type of thinking, I should like to illustrate two philosophies of grading patterns at mobile. On one hand we have the wing where everyone gets a Q. Anything less would highlight the individual, and we wouldn't want to do that. In contrast is the wing where only those patterns proficiently flown receive a Q grade. All others receive a Q− with proper annotation of the deviation. Supervisors in the second example must communicate their standards are high and be aware that deviations from such standards are inherent.

Frequent deviations from the standards, rather than reflecting negatively upon the individual(s), would indicate areas for increased training emphasis.

I would propose without hesitation, that the proficiency of the air crews in the second wing would far exceed those of the first.

The philosophy of setting high standards described above can apply to any job, not just grading landing patterns. The challenge is yours, both individually and as a supervisor. What will your standards be? What standards will you impose upon your subordinates? Can you accept setting standards demanding enough that not everyone will always attain them? What will be your reaction if everyone doesn't meet elevated standards, If you can meet these challenges, you've got everything to gain. ★

Safety's Track Record

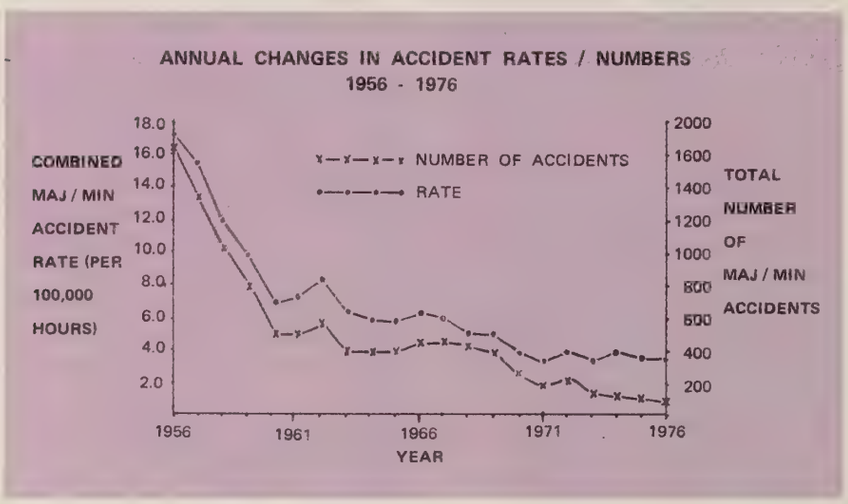
...A 20 YEAR LOOK

MAJOR THOMAS R. ALLOCCA
Directorate of Aerospace Safety



"...We had 108 accidents last year . . . 108 . . . that's about one every 3 days . . . boy, we had a bad year." This discussion conceivably could have taken place in the Squadron briefing room, or the maintenance hangar or the Officer's Club. We in safety like to think that you "out there" care about how the Air Force is doing—safety-wise. And how are we doing? Was 1976 a bummer? More importantly, what has our track record been? Has all of this "Safety comes first" business reaped any benefits? Let's turn to history for an answer.

In 1956 USAF experienced 1679 major and minor flight accidents. This translated into a combined rate of 17.0 and an average dollar loss of approximately $350,000 per mishap. Ten years later, in 1966, we experienced 440 major and minor accidents, the combined rate was 6.3 and the average accident dollar loss was about $810,000. A decade later we had 108 major and minor accidents, a combined rate of 3.5 and an average dollar loss per accident of 1.95 million. Graphically, the numbers and rates are portrayed below:



The graph dramatically illustrates the improvement in our record made through the implementation of a vigorous safety program. The fact that the combined rate has decreased by almost 80 percent shows that we have flown the mission more safely. And while the record is encouraging, perhaps the following question should be answered to provide a better assessment of safety's advances: "How do these reduced rates and numbers translate into dollar savings?" Perhaps this question can best be answered by a review of destroyed aircraft numbers and rates.

In 1956, 739 aircraft were destroyed at a rate of 7.5. By 1976, this number had been reduced to 68 aircraft destroyed for an annual rate of 2.2. If USAF had made no improvement in this very crucial safety statistic, the 1976 rate would have equaled that experienced in 1956—7.5. Since USAF flew a fleet total of 3.1 million hours in 1976, this rate translates into a *no improvement* figure of 233 aircraft destroyed. The average cost of a 1976 destroyed aircraft was 3.0 million dollars; therefore, the *no improvement* destroyed aircraft dollar loss is computed to be 233 x 3.0 million dollars, which equals 699 million



dollars. The actual 1976 destroyed aircraft dollar loss experienced was approximately 201 million dollars, a difference of 498 million dollars. *This amount represents the dollar loss savings and, more significantly, the preservation of our combat capability, realized through a 20-year improvement in USAF's safety statistics.*

Who get's the lion's share of the credit for this savings? No one individual, agency or unit. Rather, the effort has been achieved by that heterogeneous grouping known as the aviation community. This grouping includes the aerospace industry —which "engineers" safety into our aircraft; Air Force's development agencies—which ensure that our fleet is developed, procured and tested with safety foremost; USAF's operational and maintenance communities—they ensure that our fleet effectively, but safely, accomplishes the mission; and the safety agencies —which seek to ensure, throughout a weapon system's life cycle, that safety requirements are afforded uppermost consideration.

So our ability to fly the mission more safely has reaped benefits—to the tune of hundreds of millions of dollars over the past two decades. Can we improve? And what kind of a payoff will USAF realize if we do improve?

The answer to the first question is an emphatic yes! USAF's accident experiences include "lessons learned," accident board recommendations and system safety improvements which—if implemented —will enable the Air Force to continue to enhance the record achieved to date. To best answer the second question, we should compare like time intervals and our most recent accident experience.

The average combined dollar loss (in millions) for the 1967 to 1971 time interval was 358.0 million dollars per year; for the 1972 to '76 period the average figure decreased to 275.9 millions. This 23 percent decrease was realized because of the vigorous safety programs pursued Air Force-wide. If we register a similar decrease in the next five years, the average annual combined dollar loss figure will be approximately 212.4 millions. If we show no improvement—and history seems to indicate otherwise—USAF will experience a 275.9 million dollar average annual loss. The difference between the two projections is depicted below:

YEARLY INTERVAL '77-'81

IMPROVEMENT: 212.4

NO IMPROVEMENT: 275.9

The total projected dollar loss is computed as:

YEARLY INTERVAL '77-81

IMPROVEMENT: 212.4 x 5= 1.06 BILLIONS

NO IMPROVEMENT: 275.9 x 5 =1.38 BILLION

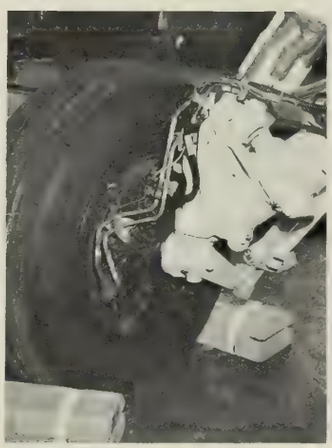
The difference between the two projections is 320 million dollars—the price we will pay if we fail to register an improvement in our safety record in the next five years.

Safety does not come cheaply: building redundancy into the flight control system of a new fighter aircraft; outfitting the fleet with a less flammable hydraulic fluid; procuring training devices which offer the best chance of producing an accident-free aircrew — these are expensive undertakings. But because USAF has undertaken similar programs in the past, we've compiled the safety record documented in this article. If we want to realize the 320 million dollar savings mentioned above, and—more importantly—if we want to conserve a fleet "second to none," we'll have to pursue those programs which offer the best chance of building upon our record. Will we? History says yes! ★

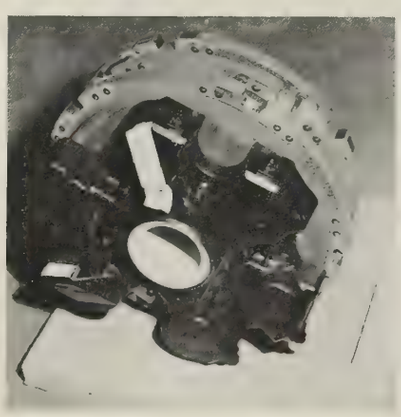
New "Whoa" Power



CAPTAIN ROBERT M. CARNES, HQ USAF/LGYYC, Washington, DC



Lightweight carbon brake installation on the F16. New fibers added to the carbon discs have allowed smaller size and retention of braking power when water soaked.



The major points of discussion about new aircraft tend to highlight powerful engines, sophisticated avionics, responsiveness of the flight controls and the total performance characteristics. Articles about military aircraft usually point out those new and superior systems that enable the machine to fly and fight better than aircraft of the adversary.

Seldom does the discussion lead to ground performance but all modern aircraft have two things in common while moving across the surface of terra-firma: a propulsion system for "Go" power and a braking system for "Whoa" power. On the ground, "whoa" is more important than go.

Military aircraft brakes have undergone an evolutionary process just as have all other systems. Brakes have progressed from none at all, in the days of the bi-wing, sticks-n-wire tail draggers, to the mechanical drum and shoe configuration. Then fluid under pressure came to the foreground as hydraulic cylinders were applied to the drum and shoe arrangement. Next came the hydraulic expandable tube brakes, then the rotating disc with hydraulic spot clincher and then the top of the evolutionary chain was supposedly reached with the stopping power of the multiple rotor-stator steel brake disc. This configuration has survived but not sufficed for many years. One characteristic of all is that they lose effectiveness when they overheat or become water soaked.

Brakes have had a quiet and rarely noticed evolution. It has been something no one talks about but that many people are presently doing something about. Imagine having total brake failure at 10 mph in a 30-ton aircraft and having to do the old "leg over the rail and boot on the ramp" trick to stop that big machine! The boot would get scorching hot very rapidly, not to mention the wear and distortion.

This heating effect is what braking is all about, for brakes must convert moving energy of the aircraft into heat energy and dissipate the heat to the surrounding air. The more energy a brake system can absorb and convert to heat over a given period of time, the more efficient it is in halting a moving object. This is all well and good, but

like the sole of the boot, heat and friction cause wear and destruction. In these days of austere funding and low spare replacement buys, the cost of owning a weapon system becomes of prime importance, even in replacing worn and warped steel brake discs.

Well, the evolution story of brakes is not over yet. In 1966, Goodyear Aerospace Corp. initiated development of brake discs made of carbon. That's right, carbon, the kin sister to the diamond. Rayon cloth was heated to extreme temperatures and converted to carbon sheets. These were trimmed to size, stacked in desired layers and saturated with a special resin or gas. They were cured to a hard material and then baked at temperatures from 3300 to 5500 degrees Fahrenheit until the resin or gas was also converted to carbon. After machining, a brake disc of strong black carbon was ready for use.

In 1970, Goodyear received a contract award for the F-15 brakes and testing started at Edwards AFB in 1972. Test results were highly successful and all prototype and production F-15s are now fitted with carbon brakes. In late 1972 a contract was awarded Goodyear for the YF-16 brakes. Presently flight testing is in progress with carbon brakes on the B-1 bomber and F-16 fighter.

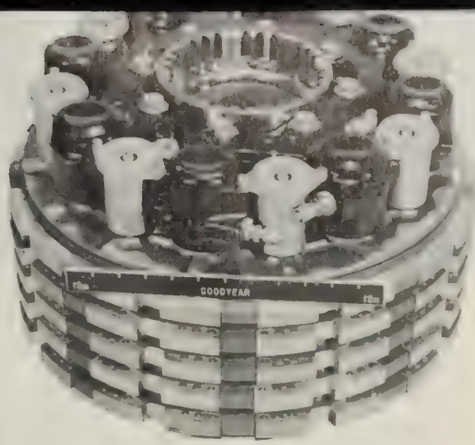
Evolution has not stood still but has had quantum leaps with the carbon brakes. A new fiber, polyacrylonitrile, referred to as PAN has been added to the disc and when converted to carbon provides a 10-15% denser disc. The denser the material, the more energy it will absorb and thus the smaller the disc has to be to provide the same "whoa" power. Another additive was infiltrated in the carbon material to prevent loss of braking power when water soaked.

What is so great about carbon? How is it superior to the steel rotor-static brake disc? The answer, from a technical point, goes back to heat. Carbon can absorb more than twice the amount of heat per pound than can steel, thus carbon brakes can be made ⅓ to ½ lighter and still do a much superior job to steel. Carbon does not melt, warp or fracture under high temperatures, thus brake failures are not a problem. Carbon has a low thermal expansion rate, 1/5 that of steel, thus brake lock-up and welding does not occur. It is highly resistant to thermal shock and can go from sub-zero temperatures to extremely high temperatures and return to cold temperatures without internal embrittlement failures. Carbon is also an excellent heat sink and can quickly move heat away from the disc surfaces to allow higher energy absorption, which equates to stopping power.

What does all this add up to, you say? Plenty! It means more safe landings between brake changes. The newest production F-15 brakes are getting about 160 landings between changes and with the new spacers to compensate for wear, this figure is approaching 450. A new carbon disc presently under development is expected to boost the figure to over 1200 landings with the use of spacers. It has meant a weight savings of 130 pounds for brakes on the F-15. For every pound saved in the brake system, this saves three more pounds in fuel and basic aircraft/landing gear structure. This is all important in our high thrust-to-weight ratio fighter aircraft. It means less "sweat" in making those maximum high energy emergency stops because of its good heat properties.

The B-1 has eight brake stacks for a total brake weight of only 512 pounds. With the bomber's weight at 360,000 pounds, a maximum energy stop requires the carbon disc to dissipate 413 million foot pounds of energy. Steel brakes trying to provide the same service would have to weigh in excess of 1600 pounds and would still be completely destroyed.

OK, you say, what about this sis-



One of eight new carbon brake stocks used on the B-1. Combined weight of all stocks is only 512 lbs.

ter to the diamond, is the cost just as prohibitive? When first developed, the cost per landing of a carbon brake disc was nine times greater than that of a steel disc. The present production version is about 1.4 times greater and a new disc under development is expected to be only .4 times greater in cost. With the use of brake disc wear spacers, our cost per landing to use carbon brakes will soon be equal to that of steel.

There are other cost savings associated with using carbon discs that are not readily visible but that quickly offset the higher cost per landing when compared to steel. The cost of maintenance manpower is not cheap. The high rate of steel brake changes, transportation to the nondestructive inspection (NDI) shop, the de-grease process, the zyglo or magnaflux check, machine shop warp check, cold press straightening, another trip to the NDI shop and installation on an aircraft all equate to manpower and supplies expenditures and dollars. Carbon eliminates all these functions with the exception of remove and replace, and that is not very often.

Well, that is what is so great about carbon for the maintenance people but what is so great about it for the pilot? It would only take one ground abort at almost liftoff speed and the performance of a maximum energy stop on a rain soaked runway to answer that question. To the pilot—carbon is worth its weight in diamonds. ★

THE IFC APPROACH

This month's article contains some of the questions most often asked concerning the material contained in the newly revised AFM 51-37. All page, figure, and paragraph references are made to AFM 51-37, dated 1 December 1976.

Q. Why have ADF procedures been omitted?

A. ADF equipment description and procedural steps for tuning were removed because of the numerous different types of receivers currently installed in operational aircraft. The individual aircraft flight manual should contain specific information on tuning and equipment description. Procedures to fly ADF approaches are still included, although not under a separate chapter. ADF information is located as follows:
Description: pg 1-24
Tuning: pg 2-17
Homing: pg 2-18
Proceeding Direct: pg 2-19
Inbound (RMI only): pg 2-22
Outbound After Station Passage (RMI only): pg 2-26
Outbound (RMI only): pg 2-30
Maintaining Course: pg 2-33
Station Passage: pg 2-33
Final Approach: pg 6-13

Q. The "NOTE" under paragraph 2-17 states that once established in the holding pattern, the first definite move by the bearing pointer 45 degrees either side of the holding course may be used as station passage indication for holding timing. Does this apply to VOR, TACAN and ADF holding?

A. No. The note only applies to ADF holding and should not be used in a VOR or TACAN holding pattern. Additionally, AFM 55-9, US Standard for Terminal Instrument Approaches, states that the use of TACAN station passage as a fix is NOT acceptable for holding fixes.

Q. Paragraph 5-5a(3) states that holding pattern teardrop offset may be up to 45 degrees. Is this a misprint?

A. No. Many pilots discovered that under certain airspeed and/or wind conditions, especially in short TACAN holding patterns, it was impossible to arrive at an inbound position from which a turn inbound would place the aircraft on-course when limited to a 30 degree teardrop offset. Consequently, the teardrop offset was increased to a maximum of 45 degrees to allow the pilot more flexibility. The following situation illustrates the rationale behind the change: An aircraft flying at 300 KTAS, under no wind conditions, will fly approximately 7½ NM outbound in 1½ minutes. At 300 KTAS, the turn diameter is approximately 4½ NM at 30 degrees of bank (reference: Figure 7-14). Since the distance between each radial is 1 NM at 60 NM, at 7½ NM, each radial is ⅛ of NM wide. 30 radials at 7½ NM are 3¾ NM wide, (30 × ⅛ = 3¾). Since the turn diameter at 300 KTAS is 4½ NM, the aircraft will overshoot the inbound course by ¾ NM, as shown in Figure 1. A 36 degree teardrop, as shown in Figure 2, will allow the aircraft to arrive on-course inbound.

FIGURE 1

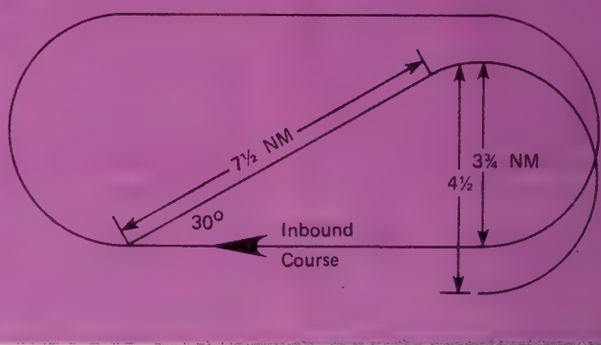
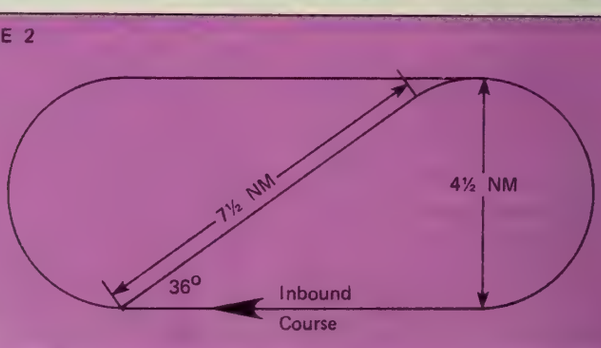


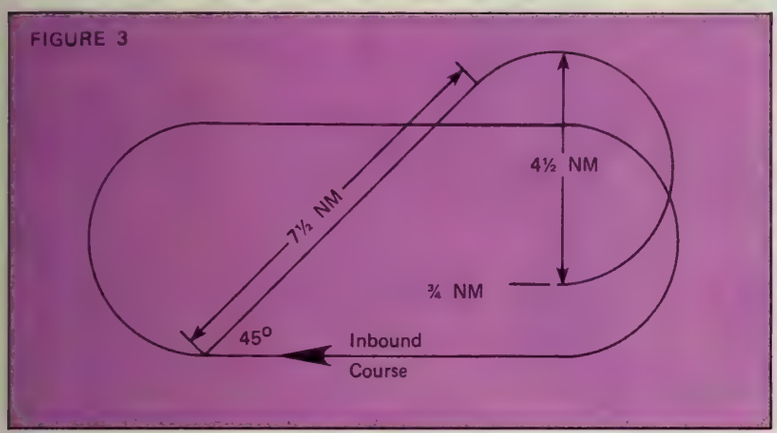
FIGURE 2



By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

Aircrews should be cautioned that in certain situations 45 degrees of offset may result in an undershoot in the same situation as Figure 3 illustrates.

FIGURE 3



The intent of this change is to encourage crew members to precompute teardrop offsets for their particular aircraft operations. The turning performance chart on page 7-15 is easy to use and since crews do most of their holding at nearly the same altitude and airspeed for any particular aircraft, one or two pre-computations should cover most situations. The 45-degree offset should allow aircraft enough flexibility for almost any TAS/wind situation, while assuring the aircraft will not exceed holding air space.

Q. Paragraph 6-5a states that upon arrival at the Initial Approach Fix (IAF) for a non-DME teardrop penetration at an altitude below that published, maintain that altitude and proceed outbound 15 seconds for each 1000 feet below the published altitude before starting descent. Does this procedure apply equally to recommended minimum and mandatory IAF altitudes?

A. Yes. The purpose of the non-DME teardrop penetration is to permit an aircraft to reverse direction and lose considerable altitude within reasonably limited airspace. If a pilot begins penetration from the IAF at an altitude below the published IAF altitude (mandatory, minimum or recommended), he may not have enough time to safely intercept the final approach course, descend to Final Approach Fix altitude, configure the aircraft, and slow to final approach airspeed.

Q. Why were "vertical S" maneuvers removed from the manual?

A. Most major commands indicated that the vertical S descriptions were not being used operationally.

Q. When the guidance contained in AFM 51-37 conflicts with other directives, such as the Dash One or command directives, which directive should be followed?

A. You should comply with Dash One procedures and/or command directives. The information contained in AFM 51-37 provides general guidance.

Q. What is the purpose of the numbers at the top center of each page?

A. These refer to paragraphs found on that page. The index only refers to paragraphs. Therefore, this new feature was included in the new manual to facilitate locating the referenced paragraphs.

Q. Who is required to have a copy of AFM 51-37?

A. Distribution is determined locally. Commanders may deem it unnecessary to issue a copy to every aircrew member.

Q. How can a copy of AFM 51-37 be obtained?

A. Copies can be requested through unit publication distribution office (PDO) account representatives. AFM 51-37 is also for sale through the Superintendent of Documents, US Government Printing Office, Washington DC 20402. The subscription price is $11.00 domestic or $13.75 foreign.

CORRECTION

The February 1977 "The IFC Approach" article, which outlines the significant changes to the revised AFM 51-37, describes, in error, a 2½ degree tolerance for determining "on-course" during descents. It is not intended for this 2½ degrees to be used for descent purposes on any approach except when the aircraft is being radar vectored. This 2½ degrees is intended to give pilots on radar vectors guidance as to when they can consider themselves "on a segment of the published routing/instrument approach procedure" so they may depart their "last assigned altitude." ★

FOR WANT OF A NAIL

MAJOR PAUL TILEY
Directorate of Aerospace Safety



The open 781 write-up read something like this: "AOA probe heater heats up all the time with power on aircraft. Circuit breaker pulled for ground operation." If you as an aircrew member were to see this write-up, it should at least cause you to ask some questions about what troubleshooting was done to clear the write-up. Every aircrew member should realize that pulling a circuit breaker does NOT constitute a proper corrective action, and that circuit breakers are NOT meant to be switches.

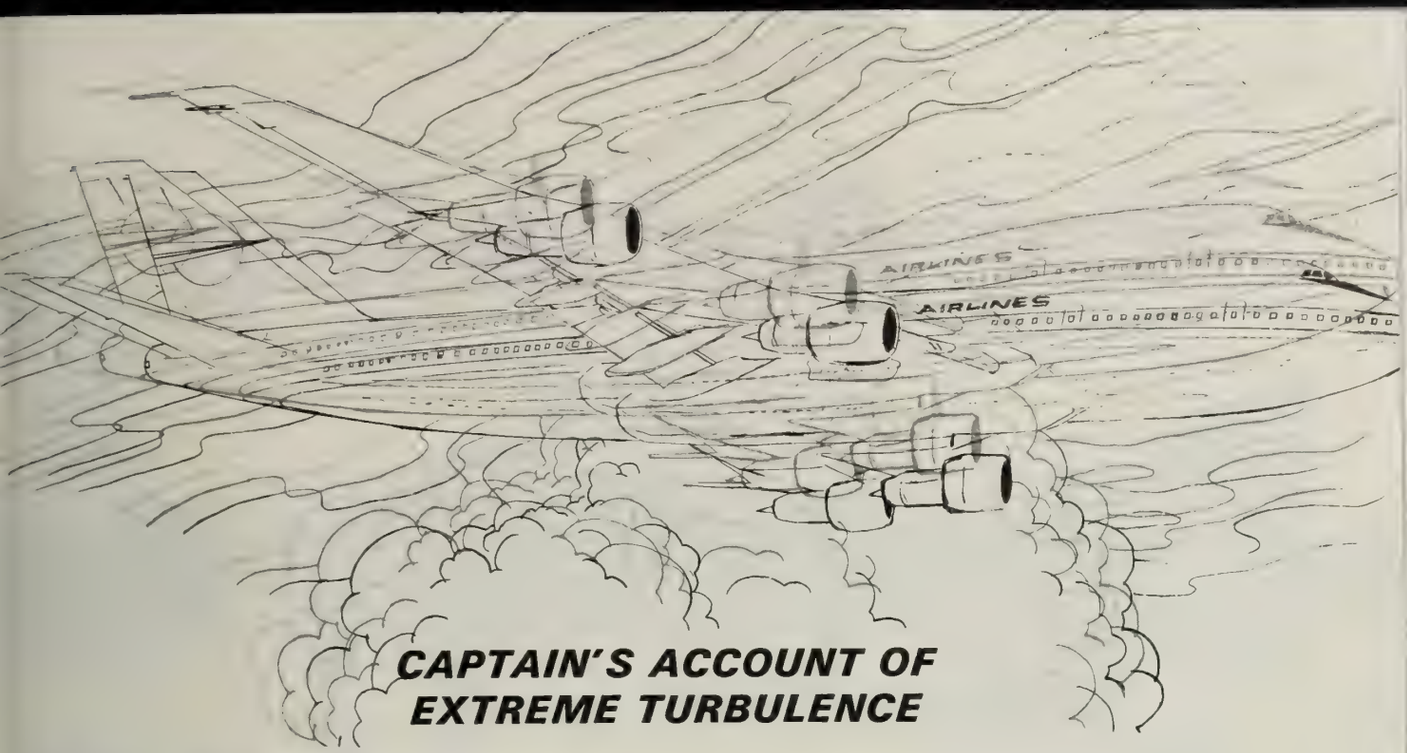
The aircrew accepted the aircraft with this open write-up apparently without inquiring any further into the cause of the write-up. This was the "nail" that *twice* nearly caused them to have an accident.

On landing at an enroute airfield, the aircrew discovered that they had NO nosewheel steering and NO normal braking below approximately 40 knots. The antiskid was turned off and the emergency brakes activated with NO apparent effect. At a very low speed, normal braking was regained and the aircrew managed to stop on the runway without further incident. Sometime during the troubleshooting, the AOA circuit breaker, which had been reset after takeoff, was pulled because of the open write-up. You guessed it, all of the problems CND'ed. No work was done on the AOA write-up, so it was still open. The aircrew decided to press on to their destination.

On landing roll at their destination, they again experienced a loss of nosewheel steering and normal braking below approximately 40 knots. This time the aircraft started to drift over to the edge of the runway. Again the antiskid was turned off and the emergency brakes applied. There was no response from the emergency brakes and the aircraft departed the runway. Fortunately, there was no damage to the aircraft. As you might guess, the AOA probe heater circuit breaker had been reset in the air again.

This time everybody agreed there was something wrong with the aircraft. Troubleshooting revealed that the scissor switch on the main landing gear was stuck in the "airborne" position. With the scissor switch stuck in this position and the AOA probe heater circuit breaker IN, the aircraft would NOT have nosewheel steering or normal braking below approximately 40 knots. The aircrew did not discover this sooner because the circuit breaker had always been reset after takeoff. Additionally, with the brake valves that are presently in this aircraft, the emergency brakes will not work if normal utility hydraulic pressure is available.

The failure of maintenance personnel to properly troubleshoot the AOA probe heater write-up was the basic cause, but the aircrew almost bought the accident *twice*. Scissor switches and circuit breakers may have many functions. A "simple" solution like pulling a circuit breaker can be the "nail" that sets you up for an accident. Know your aircraft. ★



CAPTAIN'S ACCOUNT OF EXTREME TURBULENCE

This airline captain's account of an encounter with extreme clear air turbulence appeared in the Jan 77 issue of Crosscheck, *Pan Am's flight safety publication. The aircraft was a Boeing 747.*

At approximately 1614Z, near 66N 41W, FL 350, G.W. 600,000 pounds, the flight encountered turbulence which caused me to be concerned with the structural integrity of the aircraft.

Due to previous light chop, passengers had been warned to keep belts fastened at all times. The seat belt sign was off at the time of the encounter. Fortunately no injuries were sustained.

OAT −53C wind 180/110 air smooth, M.84. With no warning all hell broke loose. Put A/P to "turb" mode, seat belt and no smoke on. Rapid oscillations in roll and yaw, very little in pitch. I don't believe a human could have controlled the aircraft manually—oscillations too rapid. My main concern was the possibility of shedding engine pods. As near as I could determine, excursions approaching 40° in the roll axis occurred, mainly to the right. Speed indication was difficult to determine due to rapid fluctuation. I saw one indication of .87 at the highest and .80 at the lowest. Engine rpm was kept in vicinity of 91 to 93 percent N1. Caution panel lights blinked on and off—mainly engine oil pressure.

I believe both high and low speed buffet were felt. The airstream noise variation is difficult to describe—approaching thunder on the high DB side and eerie silence on the low.

First officer read OAT and wind indications. Highest OAT read −41° lowest wind readout 084 /58 kt. At 1615 I attempted to warn other aircraft in the area, freq 129.7, no reply. Transmitted on 121.5 blind our position and situation. At approximately 1630 turbulence became moderate and I was able to communicate with the cabin to ascertain no injuries or damage sustained (except for galley chaos).

OAT stabilized at −48°, wind 110/90. During the turbulence the aircraft had been allowed to settle to 34,600 feet. After assessing our situation in smooth air, we climbed back to 35,000 and continued enroute. ★

SAFETY RECORD

The 103 TAC Fighter Group, Connecticut ANG, has compiled an excellent record of 10 years and 50,000 accident-free flying hours. Most of this time (40,000 hours) was logged in single engine F-100 and F-102 aircraft. This 10-year record encompassed two airframe conversions and a shift of mission from ADCOM to TAC. In the picture above, Lt Col Peter Cascio, Commander of the 118th TFS, helps celebrate the milestone with 1Lt Bill Kirkland after Kirkland completed the final flight last September that marked the 10-year record.



Hot Refueling



. . . a term used for refueling an aircraft with one or more engines running. Combat tested in Vietnam, this refueling procedure increases readiness by reducing ground turnaround time, increases sortie surge and optimizes the efficiency of manpower and equipment.

SMSGT OWEN G. BERNHARDT, HQ USAF/LGYF

Hot refueling system, unique to most of the Air Force, has been under design and construction in US Air Forces Europe (USAFE) since 1970. The USAFE hot refueling system is not the same as the hot refueling operation that was used in Vietnam. The USAFE operation is a sophisticated, advanced system, designed with safety as well as mission capability in mind. Designed primarily for the F-4, the "Hot Pits" have many new safety devices and automatic controls not required in conventional refueling systems. The best way to describe this new refueling method is to start at the aircraft and trace the system back to the storage tank.

At the skin of the aircraft is an improved single-point refueling nozzle to which a newly-developed "dry-break" coupler is attached. The coupler is designed with an automatic shut-off valve to stop fuel flow when it is disconnected from the refueling nozzle. This feature provides an added measure of safety to the pilot and ground crews in an emergency situation.

Next is a reinforced hard rubber hose, approximately six inches in diameter and six feet long, attached to an aluminum swing arm pantograph. This replaces the 50 foot collapsible rubber hose presently being used for refueling operations.

CONTROL PIT

The fuel control pit is located about 50 feet from the aircraft, and is controlled by a pneumatic rather than an electrical system. Air pressure must flow through a "dead man" control switch, which must be hand-held and depressed to be in the "on" position before fuel flows into the aircraft. This system eliminates all electrical

connections at the hot pad, which can be a potential source of sparks and ignition.

If excess fuel flow (surge) or any hazardous situation develops, a flow control valve instantaneously stops the fuel flow. The flow control valve is set at a maximum flow rate of 570 gpm. If the fuel line or nozzle should rupture or disconnect, fuel flow would momentarily increase and exceed the 570 gpm limit. When this occurs, an activated valve automatically shuts down the fuel flow.

Next in line to the fuel control pit is the filter separator house, where control fuel line pressure gauges are installed. These sensing devices control the two independent 600-gpm fuel pumps, based on the fuel demand or fuel pressures. When the system is not in use, the fuel is kept under static pressure; but as the flow valve is opened by the pneumatic control valve to start the fueling operation, the fuel pressure drops, which automatically turns on the first fuel pump. If a second aircraft is refueled simultaneously, the pressure will drop again, turning on the second pump. Fuel pumps are automatically turned off as the demand for fuel decreases and the fuel pressure increases.

CONTAMINATION MONITOR

Before the fuel enters the pumps, it passes through a constant fuel contamination monitor, which shuts down the fuel flow if water, rust or sediment is detected in the fuel. However, this situation is not likely to occur since the fuel goes through filter/water separators as it enters and leaves the fuel storage tank. The filter/water separator extracts water from the fuel, and drains it into a "waste" collection tank where it can be disposed of. As an added quality control feature, all internal piping is constructed of high-pressure, corrosion-resistant aluminum.

As an added safeguard the storage tank is designed to be self-cleaning. The epoxy-coated interior has a five-degree sloped bottom to allow water and sediment to collect in a sump at the bottom of the tank. This residue is then pumped into the waste collection tank for further disposition or reclamation.

Emergency shut-off switches are located throughout the system. These added safety devices are easily activated, but require a special key to be disengaged. In this way, the system cannot be accidentally overridden and placed back into service after a safety discrepancy is detected.

SYSTEM SAFETY ENGINEERING ANALYSIS

The final step required to place this system in operational status is to have a system safety engineering analysis conducted on the system, the aircraft, and the aircraft and system coupled together under actual fuel flow hot refueling conditions. Fuels experts at Air Force Headquarters tasked the Air Forcce Logistics Command (AFLC) to perform the system safety analysis. AFLC assembled a team from AFLC, Air Force Systems Command (AFSC), the Pentagon and an on-site evaluation was conducted at Ramstein AB, Germany. The main thrust of the analysis was to evaluate procedures and the hardware for possible error or failure which could result in a hazardous operation. Even though the analysis identified some procedures that needed strengthening, and a couple of hardware redesigns, the refueling system truly represents a significant "state-of-the-art" improvement over other fueling systems.

When the USAFE hot refueling analysis was completed, Pacific Air Forces (PACAF) requested that a system safety engineering analysis be conducted to determine the feasibility of hot refueling with mobile refueling and air transportable hydrant refueling systems. Again AFLC was tasked to conduct the analysis for PACAF. The team traveled to OSAN AB, Korea for the on-site evaluation and analysis. After several days of reviewing procedures and hardware, they found that the hardware would not permit recommending hot refueling. The major weaknesses were the single-point fueling nozzle, the coupler, the fuel hose and the marriage between each of these components.

The team did envision the use of an aluminum swing arm pantograph similar to the USAFE fueling system. Once back in the States, they pursued this idea and funds were made available for the development of two prototype pantographs. Two were constructed and a feasibility demonstration was conducted at McDill AFB, Florida. The results of this test revealed that the pantograph provides a safe environment for hot refueling when coupled to mobile, permanent hydrant or air transportable hydrant fueling systems.

It is anticipated that as a result of this feasibility demonstration, a requirement for two district pantograph systems will be developed; (1) A pantograph system configured for use in bare base deployment situations, and (2) a pantograph system to modernize existing hydrant systems. Air Force fuels experts believe the pantograph will provide a viable and safe means to hot refuel from any fuel source. ★

The SLUF In A Different Sky

LT COL DOUGLAS W. STOCKTON
Commander, 356 TFS, Myrtle Beach AFB, SC

The deployment of TAC fighter squadrons to Europe for participation in NATO exercises has been a matter of routine for many years. For a group of A-7D pilots of the 354th Tactical Fighter Wing at Myrtle Beach it was to be a first and very rewarding experience. They would be participants in Coronet Redcoat, the deployment of 18 A-7D aircraft to Lechfeld Air Base in Bavaria where they would fly close air support missions in exercises Cold Fire and Reforger.

The support rendered by our Luftwaffe hosts was nothing short of magnificent. Jagdbombergeschwader 32 (Fighter Bomber Wing 32) welcomed the squadron as one of its own, alongside their two F-104 squadrons, and met or exceeded virtually every housekeeping or operational requirement at



first mention. Thus, the feasibility of operating the A-7D from a German base was, for all practical purposes, readily proven.

Of greater interest, however, to those who will be making similar journeys in the future are some of the problems we encountered in transitioning from admittedly crowded airspace in the CONUS to an environment of eye-watering proportions in Europe. Congested airspace, weather, ground controller terminology, and differences in flight rules all dictated thorough planning and preparation before entering the exercise arena.

Homework began two months in advance of deployment. We first ran everyone through the flight simulator to practice each instrument approach to primary and alternate bases at least twice. A glance at the European letdown plates will show that, for the most part, the approaches are extremely busy and challenging, as a result of airspace limitations, and that no amount of study and practice can be considered excessive. This was particularly true of standard instrument departures (SID) which were unavailable to us prior to deployment.

The SID, surprisingly, turned out to be a part of the routing out of the exercise areas. Air traffic control facilities became saturated in marginal weather conditions and were thus unable in all cases to provide the luxury of enroute climbs, descents and radar vectors. Hence, the flight plan would normally take us to a NAVAID near the exercise area where we would penetrate and transition to VMC. Upon departure, we would proceed back to the NAVAID and climb out via a SID. This usually created a great flurry of paper in the cockpit, once the SID was announced.

We also devoted a great deal of time to the study of Lechfeld and its environs. According to an earlier safety survey, approach end cable engagements, should they become necessary, would have to be made against traffic and with ten minutes prior notice, since the real approach end cable was disconnected for F-104 operations. The runway width was 98 feet which meant that single ship takeoffs and landings were the order of the day. Departure and arrival traffic patterns were dog-legged in the interest of noise abatement, a crucial requirement in heavily populated West Germany.

To prepare us psychologically, USAFE headquarters and the 52d







The support we received from our German allies was superb. Everything we could have asked for was provided as though we were one of their own squadrons.





Tactical Fighter Wing at Spangdahlem sent a briefing team to Myrtle Beach to clue us in on European flying and to test us on buffer zone procedures. The more memorable aspects of this briefing were time lapse photography of meganumerous arrivals and departures on a London radar scope and selected recordings of air-to-ground radio transmissions, which were marked by an abundance of clutter and strange accents. Mentioned also were the gliders, hot air balloons, and light aircraft which we might have occasion to dodge on low level nav routes. We, therefore, departed CONUS with an above average, yet healthy, degree of apprehension about European flying.

Our apprehensiveness was greatly reduced upon arrival, however. A full day of briefings by our GAF and USAFE counterparts in operations, air traffic control, weather, flight safety and stan eval covered all aspects of both normal and exercise flying which we could anticipate in the next three weeks. The briefings were followed by local area orientation flights for our IPs and flight leads on the wing or in the back seat of F-104s. There was widespread agreement that we could not have asked for a more thorough and professional indoctrination.

Now began the process of verifying all of our planning and all that we had been told in the past couple of months. It was all true and then some!

Flight planning could have had all the symptoms of a migraine headache had it not been for a stan eval rep from the 52d Tactical Fighter Wing at Spangdahlem who was at our side for the entire stay. Flight plans and their content arrangement were not your standard 175 or ICAO layout. Additionally, USAFE rules governing weather alternates, for example, were more stringent. In some cases, two alternates were required and this meant A-7 bingo fuels on the order of 5000 pounds for remote exercise areas. (That's a lot of gas for a miserly turbofan!). However, with the help of our man from Spangdahlem, stereo flight plans and low level routes were quickly developed and de-conflicted, enabling flight leads to simply state their intentions to Lechfeld Base Operations and they were on their maximum IFR way. This provided more time for briefing the more critical aspects of the exercise scenario and employment tactics.

The weather was good by European standards for September but not what we were accustomed to at home. Fronts had the habit of stalling at the Alps, producing two

to three day stretches of fog and low stratus in the mornings followed by a lot of puffies in the afternoons. More than once we encountered steady ceiling and visibility deterioration as we progressed along low level routes toward the exercise objective. When completely boxed in, the GAF last ditch procedure called for a 7700 squawk and a rapid climb to VMC. This procedure held little appeal due to the amount of aluminum up above, and flight leads, therefore, tended to make their low level abort decisions a lot earlier.

Air traffic was heavy as advertised, especially in the exercise areas and along low level routes. Balloons, gliders, and light aircraft were out in great numbers, especially on weekends, but were accurately forecast through NOTAM's on our GAF provided teletype machine. (This machine also provided up to the minute weather information.) The heavy traffic, coupled with routes and working areas in or near the buffer zone, required wingmen to be especially vigilant and to pull more than their usual share of the navigational chores. "Checking six" naturally suffered as a result.

Traffic Control on the IFR segments of our missions was superb, considering the volume of civil and military air handled. Accents and terminology were quickly adjusted to and misunderstandings virtually eliminated after two or three flights. We found on frequent occasions, however, that it paid to repeat instructions back if there was any doubt. Terminal air traffic control, particularly during GCAs, was unbelievably precise, despite what we considered to be nonstandard terminology. It was not uncommon for GAF controllers at Lechfeld to have been there at the same job for more than ten years. That kind of tenure combined with numerous saves in bad weather undoubtedly contributed to their high degree of precision and competence.



Despite all our study before leaving Myrtle Beach, there was a great deal to learn once we arrived at Lechfeld. But, the professional thorough indoctrination from our GAF and USAFE counterparts took away much of the apprehension.

A major problem in the opinion of many pilots was the congestion on radio frequencies in the exercise areas. With the large number of agencies and nationalities involved in a confined area, it was not uncommon to run through as many as five frequency changes to find one that was workable. Memorization of several backups proved to be the answer, especially in the heat of battle.

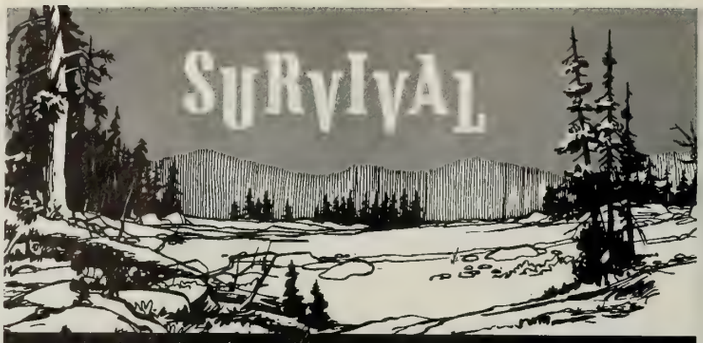
Overall, one would have to say that the trip was extremely profitable and educational in all respects. Thorough preparation, beginning well in advance of deployment and sprinkled with liberal amounts of flexibility during the employment phase, proved once again to be the big key to success.

And if you're wondering about the cable engagements against traffic—we had two of them. Both were successful and in both cases the GAF crash and rescue personnel had the runway open again in less than ten minutes. Scarcely 100 feet from the edge of the runway on both occasions was a large cheering section of our German pilot friends who rarely get an opportunity to observe such feats. Perhaps that had a lot to do with the way things turned out. ★

BIOGRAPHY

Lt Col Douglas W. Stockton

A 1957 graduate of the US Military Academy, he has served as an ATC instructor pilot, advisor to the Royal Thai Air Force and as airmanship instructor at the Air Force Academy. Following a combat tour in A-37s in Vietnam, he was assigned to Operations Plans, HQ PACAF, and later served as executive to the Vice CINC. He was assigned to Myrtle Beach AFB in 1974 and has been squadron commander of the 356th Tactical Fighter Squadron since February 1976.



SOS

SGT AL KUEKER and
CAPT R. E. VIVION
3636 CCTW
Fairchild AFB, WA



Signals of one type or another are used by everyone, everyday. Pilots get a thumbs-up from a crew chief when a particular part of a pre-takeoff check is complete; navigators give a verbal signal to the aircraft commander when all of their systems check out; jumpmasters signal their jumpers when to hook up, jump, etc; and, of course, there is the obvious—SOS—a call for help that is recognized around the world.

We use the verbal or audio means of communication whenever possible, but when that medium is removed, we resort to the visual, in a wide variety of design and complexity. Visual signals are the topic of this month's issue of Survival.

In a survival situation, several instances may preclude success in using your radio or beacon. First, those pieces of gear may not work. They are designed so that they can survive a lot of punishment, but, like any piece of equipment, they may fail. Enemy activity, inability to talk, transmissions at times when friendlies aren't around—all will impact on the ability to get your message across. So it's important that you be at least knowledgeable in the use of surface-to-air signaling devices.

The signal mirror, strobe light, whistle, MK-13 flare, and pen gun or gyro-jet are all designed to make your position known to a potential rescuer. They're good signals, but we've discussed them at length in past articles. Next to the radio, they are probably still your best means of getting your message across. However, they are all active devices, requiring some action on your part to activate them. The signal that you lay out on the ground has the advantage of being passive. It works continuously and doesn't require you to stand around and fire it off. But, I'm getting the cart before the horse. Let's discuss some of the principles of these signals.

PASSIVE GROUND SIGNALS

Three considerations are important. First, the size of your signal is vital to its success or failure. Make sure you make it big enough to be seen, but not so big that you spend all day building it. Obviously, the quantity of materials and the amount of space available will dictate how large you can make it. Naturally, some folks go to extremes. One fellow who was stationed in the Canadian wilderness, to maintain a piece of electronic equipment got bored, and, having nothing else to do, decided to "signal" the jet liners overhead. Since he had a large tractor and snowplow at his disposal, and unlimited acres of snow, he built a 4-letter word that was big enough to be clearly visible from 35,000 feet. It also adequately passed on his feelings of frustration. But what you say doesn't really matter since any signal will draw attention. When building strip signals out of panels of parachute material, use the six to one ratio; i.e., make each panel 18 feet long by 3 feet wide, or any other multiple of 6:1. (Note: The 18 x 3 dimensions are considered the minimum to be effective.) Again, this principle says make it big enough.

The second principle concerns form. Straight lines or geometric designs do not exist on a large scale in nature. So, make your signals so that they do not look like they naturally belong in that area. Take advantage of natural features.

however. For example, if you are in a valley, make your signal run across the valley and not parallel to the drainage. Also, look for an area that will give maximum visibility or exposure to your signal. This may even require that you travel to an area that affords better exposure for your efforts. However, 97 percent of our crews are rescued within four hours, at the site of their emergency, so that decision should be made only under extreme circumstances. The point to remember is, if you don't know what's ahead, you may be leaving the best signaling area for miles around. Consider all factors before striking out.

The third important principle applies to contrast. Green material put out in a nice green meadow obviously won't work, unless there is a definite color contrast. So accentuate the color differences. Using orange parachute material on a snow-covered area or the white in the dirt will provide good contrast. If you can't spare any canopy material, consider using overturned sod, stamping in the snow, piling brush in a design, or even clearing brush from an area. Any means to make your signal contrast with the surroundings should be used. Use your imagination. A pond dyed fluorescent green with sea marker dye stands out like a sore thumb—even from 35,000.

You no doubt have heard that American Indians used smoke signals to pass on a message. It worked very well, and for that matter still will. Smoke signals can show your location very effectively, provided you have the necessary materials. White smoke against a blue sky shows up well whereas black smoke is most effective on an overcast day. The white variety can be made using dry wood, wet or green grasses, pine boughs, etc. Black smoke will be produced by fires from aircraft parts such as electrical insulation or tires and from the fuel or oil. Some woody plants found in desert areas such as creosote bush, sagebrush, or some junipers will produce a dense black smoke when burned. This is caused by the high creosote content of those plants.

You are probably aware that a triangle of fires, signals, etc., is an international distress signal. If you have the fuel, time, and terrain to build a triangle of fires, have at it. But make sure each fire is far enough away from its neighbor to keep the smoke columns from blending together. Better yet, build one big fire and don't try to race from one to another keeping three going, or worse, trying to get three started as the search aircraft drones off over the ridgeline. Also, if you tie your MK-13 flare to a stick and allow the orange smoke to be drawn into the smoke column of your fire, you can end up with a very large cloud of orange smoke.

Several notes of caution apply directly to the use of fires. First, a big bright fire at night will be an effective signal to aircraft—especially if it covers about 5000 acres. Be careful—15 smoke jumpers putting you out with axes and shovels should rate high on your "must miss" list for today. Consider the area, terrain, and how dry the forest is before you begin to build a signal fire. Another note pertains to maintenance—you have to keep feeding a fire, for best results. Have sufficient fuel available to keep it going. Take care of your other signals too. Go back daily and improve or repair them. Wind, snow, rain will all affect the quality of your signal and will require that you work at keeping it up to speed.

Surface-to-air signals aren't complicated if you keep the principles in mind. Remember size, form and contrast, and don't try to write your life history—keep it simple.

If you have questions or comments concerning the information contained in this article, please call or write to:

3636 CCTW/DOTO
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AUTOVON: 352-5470 ★









Crew Coordination

...you, your crew, and your responsibility

Your emotions and those of your crewmembers have an important effect on how well you do your job. You are not supposed to be a psychologist, but you do need some familiarity with the effects which changes in the personal lives of your crewmembers may have on their performance.

CAPTAIN
LAWRENCE R. CHALMER
Pease AFB, NH

One of the most easily overlooked aspects of aircrew coordination on a multi-seat aircraft is that of crew ambience—the tone, the environment of the particular crew. That's abvious, you say? You know how everybody's feeling today, how you'll work together. Do you really know?

Let's look at a six man B-52 crew as our first example. What's bothering the copilot? He's slow on checklist. The AC snaps at him. The nav is concerned about something and misses a timing call. The radar nav hasn't said anything all day. The EW omits replacing his seat pins and the gunner mutters as he reminds him.

What's going on with this crew? More important, what is happening on your crew? How have *you* been working lately? What do you and the other people on your crew carry onto the aircraft with you besides your equipment? I'm suggesting that you take a good look at the personalities on your crew (or crews, if you're their supervisor), in addition to their crew specialties. What might they have on their minds, and you on yours, in addition to professional duties? Are you naive in thinking that there is no room on the airplane for personal problems? Perhaps not. But there *will* be personal problems and concerns on board. The more important the problem to the individual, the more it will affect his work. Unrealistic? Think back. How well did you perform the day your wife delivered, when she was hospitalized, when a loved one died? How well did you work as a crew after you returned from leave?

Too many questions? Let's consider four of the most obvious areas of individual concern as they interrelate and affect your performance: Your family, your (and their) health, your finances, and your job.

FAMILY

How does your flying or alert schedule affect your family? Do you and your wife have the blues the day before you start alert/TDY? Are you able to adequately explain to your children what keeps you from home? There are no model answers to these questions. Your schedule affects the lives and the personalities of others. Accept that and realize that what happens at home is carried onto the job, the airborne job. If you've had a family fight, do you take it out on your crew, or vice versa? Has your bachelor pilot or nav been having social problems that keep him preoccupied?

How you relate to your crew in response to family joys, pressures, or problems is important. A degree of introspection may naturally be difficult, yet "knowing thyself" creates a more aware person, an individual





who functions more easily in the airborne role.

HEALTH

Few problems carry the immediacy of medical ones. It is extremely difficult, if not impossible, to divorce ourselves from thinking of loved ones in pain or physical discomfort. Emergency leave, you say? Have you spent an alert tour or been overseas with a man whose family was hospitalized? Have you been that man? Emergency leave may not always be possible. But understanding and acceptance of the individial is *always* possible. If a crewmember is concerned with his own health or the health of someone close to him, *you* may see his performance change. Be aware that it will change and be ready for it. If *you* are that person, be more watchful of the routine portions of your crew duties, the areas you may neglect first through preoccupation.

FINANCIAL

Money. Few of us have too much of it; therefore, our concerns lie with making and distributing it. The distribution process involves problems that not only are compounded quarterly, but that must be documented yearly. The financial headaches of a crewmember are as easily carried to work as any other. They may be felt to be as pressing as medical problems and may be even more difficult to alleviate. Buying a new home or trying to arrange base housing? Your crew duties are time consuming enough even when your finances are stable. If you and your crew can recognize each other's feelings and financial worries, you might prevent inadvertent errors on the job.

YOUR JOB

Any major changes in an individual's working conditions will affect the way he sees himself and others. Have you changed crew seats through upgrading? Are you now at a new base in a new airplane? As your roles and their expectations change, your behavior will consequently change. Your peers will naturally sense these changes, and it is equally important that you realize them. "He's new on the job" means little during an in-flight emergency at 480 knots.

A second working condition responsible for major behavioral change is the PCS. Here the crewmember's entire environment is disrupted. His family, health, wealth, and professional roles may all be changed. His self concept may change radically, and with it his in-flight behavior. A man new to a base or position, for example, may work within a closed environment until he feels secure in his new job or environment.

Equate the above areas of concern with your flights of the last year. What was on your mind? Have you descended early, missed an altitude, overshot an airspeed? Has your mission plansing been detailed or hurriedly completed—"I've flown this mission many times before. . . ."

I'm offering no pat solutions for *you*. The path to that solution begins with self-awareness. You—as rated professional, crewmember, supervisor—are an individual subject to change. What affects you at home will affect you at work. Cognizance of your own and others' behavior in response to familial, medical, financial, or occupational variations will allow you to better prepare for your operational duties. Expecting crucial personal matters to produce changes in proficiency permits us to recognize and possibly avert problems in crew coordination and safety. ★

ABOUT THE AUTHOR

Captain Chalmer is an FB-111 navigator in the 393d Bombardment Sqdn, at Pease AFB, NH. His military career includes service as a B-52 navigator and Air Staff Training Officer. Captain Chalmer has attended Squadron Officer School, Air Command and Staff College (correspondence) and has an M.A. in counseling from Central Michigan University.



Radar Myth . . . Conceptions

Although written for general aviation, this article from FAA's General Aviation News *tells how it is in the radar environment. We recommend it for USAF crews for their information as to the kind of protection traffic control provides for both them and for the general aviation pilot who may lack sophisticated IFR equipment.*

It is one of those ideal weather, built-for-flying afternoons. You are cruising along VFR, no clouds, no worries . . . then in an instant, the unthinkable: Aluminum overcast for a millisecond—a wing, a blur of numbers, another pilot's face flashes by, mirroring your horror. Then he is gone as quickly as he came, leaving stillness and empty blue skies in his place.

You have come face to face with a pilot's nightmare, a near midair collision, and you will never be the same again. It is frightening. You are weak, you are scared, your hands are trembling. Then you feel angry and keep getting angrier—you grumble: They spend millions on exotic ATC radar, everyone knows, but there was no warning, none of the "advisory service" advertised. They can program computers to read an aircraft's altitude and flight number without a word being spoken. But they didn't warn you—or the other guy, presumably, that you were dead on target for an aerial smashup. What's wrong with this elaborate, expensive system, anyway?

The answer is that nothing is wrong with the modern air traffic control radar system, except possibly the airman's conception of it, what it can and cannot do. The continuing development of more sophisticated and automated equipment has given

rise to the notion among some pilots that controllers are watching their every move enroute, and will always be able to warn other aircraft—particularly those flying IFR—of their presence. This is the misconception that can kill you.

The adoption of radar into air triffic control brought with it a series of increased capabilities which have continued over its 20 year history. From the earliest days, when radio operators had to guess at locations, times and speeds of aircraft, we have gone through "raw" radar to transponders to modern computer-augmented machinery that can spit out a wealth of information on command, right on the controller's scope.

These new radar/computer capabilities have unquestionably enriched the capabilities of the airway system and brought us closer to the much desired day when collision avoidance for virtually all aircraft will be practical. But the glowing wonders of each new radar or its added capabilities encourages some of us to overlook the fact that current radar is not all-encompassing in its coverage, does not pick up all aircraft at all times, and is primarily concerned with the separation of IFR traffic.

Originally developed during World War II, radar (Radio Detection and Ranging) had as its initial purpose not the separation of aircraft, but detection of enemy aircraft. (See "The Big Eye," FAA GENERAL AVIATION NEWS, August 1975). Later developments resulted in radar being used for the positioning of aircraft. Fighters were joined up with the bombers they protected in this way, and many other uses were found for radar. Most of the research aimed at improving the outer range, ignoring the "ground clutter" —the undesirable returns from nearby trees, fences, etc., which covered the center of the scope.

After the war ended and radar found its way into air traffic control, ground clutter became an increasingly serious problem for terminal radar. Some of today's most sophisticated black box circuitry is aimed at reducing this phenomenon. Modern radar does a magnificent job compared to the old days, but clutter is still there. One way of reducing it to a minimum results in weakening radar's sensitivity to certain distant aircraft targets. The person affected in this trade-off is the pilot flying an airplane whose radar-reflecting properties are weakest. This group includes many small general aviation airplanes flying VFR without active transponders. In some situations these aircraft are not "painted" on the radarscope, even though they are within range of the transmitter.



The new capabilities of radar/computer assisted air traffic control means much better collision avoidance, but it is still not all-encompassing.

Some pilots think of IFR as a kind of security blanket. They say to themselves, "I'm on an IFR flight plan; therefore the air traffic service is going to tell me about all the traffic I might encounter." So they settle back in their seat in imagined safety.

WHO IS RESPONSIBLE

The fact is that when operating in VFR conditions, regardless of flight plan, responsibility for seeing and avoiding other traffic rests with the pilot, not the controller. Civilian radar was developed primarily for the separation of IFR traffic from other IFR traffic. That is still the controller's prime responsibility, although he will also assist VFR traffic as much as time and facilities permit, calling the pilot's attention to any known potential problem or immediate hazard. Radar advisory service for aircraft is specifically designated as a duty that follows the priorities of separation, safety advisories, and other required controller actions, to be performed on a workload permitting basis only. Furthermore, at any given time the controller may not be getting any return from your aircraft —or from your potential traffic.

But, you ask, what about that VFR day when you were level at 4,500—certainly high enough to be in coverage—and Center missed telling you about the T-38 that nearly skewered you? Traffic was light, so you know the controller should have had time to help you.

Believe it or not, there are days when the weather is "good" for flying, but maybe not so good as far as radar is concerned. Wind, temperatures aloft (particularly when inversions are present), dew point spread, and clouds can all have effects on radar that produce clutter, or reduce radar efficiency often right where you or your traffic are. In addition, the angle at which the radar antenna is tilted can result in some traffic not being seen at certain altitudes. Statisics show that the bulk of IFR traffic—the kind Center radar is primarily interested in, remember—spends most of its time at relatively high altitudes while en route, so that is what the en route radar is designed to see.

In terminal areas, the heavy traffic areas are within 30 miles of the airport at altitudes varying with the location; again, the radar is focused



RADAR MYTH—CONCEPTIONS

continued

for the area of greatest use. At 40 miles out you are in all likelihood within range of the radar signals, but the controller's scope may only be displaying targets closer in. Another factor to keep in mind is that there is virtually always a cone of non-coverage directly overhead the radar antenna. All these things leave some rather wide open air spaces where there is no VFR radar coverage at many altitudes.

Certain kinds of general aviation aircraft are detected by radar with more difficulty than are others. Smaller airplanes; those made in great part of materials other than metal; aircraft without propellers; and slow moving craft all have less reflecting ability than others, resulting in less return of energy to the radar antenna. Consequently, the primary targets they produce are weak or often non-existent. An airplane also presents less of a target to the controller when it is flying directly toward, or directly away from, the radar antenna.

WEATHER RADAR

The airman's oldest adversary—weather—often enters the picture. One of the current uses of radar, other than air traffic control, is in weather observation and forecasting, and weather returns tend to blot out aircraft. True, controllers can lessen to some extent the strength of weather returns, but this ability is not absolute and often it is desirable to display weather for use when pilots ask to be vectored around rough areas or storm cells. Other aircraft may be "wiped off the scope" by this display.

In short, the concept of 100 percent radar coverage has to be understood in terms of stated goals, present and future. Questions put to FAA "Listening Sessions" reveal that some pilots believe any time they hear "Radar Contact" the controller has taken over all separation responsibilities. At the very least, these pilots believe all air traffic in the area is shown on the controller's scope. This assumption can be a fatal error—for any of the reasons given earlier. Radar does not protect from unidentified aircraft or those which may not be showing up clearly on the radar scope, such as VFR traffic that has entered into an IFR environment.

Radar advisories are an infinitely useful aid in helping the VFR pilot maintain his own separation, but they are not to be regarded as evidence that a controller has taken over responsibility for such separation.

What can the pilot do to increase the protection available from radar?

• Much of the problem could be solved by the acquisition and use of a transponder. If you have never visited an air traffic facility with radar, do so and see the difference on the scope between a transponder reply and the blip from a non-equipped light aircraft. The contrast could surprise you—the typical transponder ident "slash" is many times the size of the small dot that represents the non-equipped airplane. Transponders make the size of the airplane irrelevant; transponder replies are the same size for a 747 and for a Cherokee.

• If you have a transponder, particularly w/mode c alt. reporting use it. Many pilots turn the transponder off when leaving terminal areas to "save" it or lengthen its operating life. There are two dangers in this practice: One is the weaker reply enroute that makes you less visible on the controller's scope, and the other is the possibility of forgetting to turn it back on at your destination area. By the time the destination controller asks if you can "squawk," it is long past the time that you should have been using the extra help of a transponder to show all your progress and altitude through busy airspace. It is true that you might not be sending a signal en route if you get out of an area of radar coverage, but what is wrong with leaving the set turned on to get you back on the scope as soon as you again enter coverage? Another advantage is that the target generated by the transponder does not easily get lost in clutter, between antenna sweeps or precipitation returns.

• You can help the radar controller help you by not adding to his workload unnecessarily when he is in the process of identifying your target. Remember that he may be looking at many unidentified blips on his scope. Knowing where you are at all times simplifies the task of establishing radar contact—and shortens the time when you are present as an "unknown." ★

(From material presented by Charles Douglas, FAA Central Region.)

—*Courtesy* FAA General Aviation News/*January 1977.*

Know Your Local Barrier...
...eh...cable...net...or whatever!

MAJOR LAWRENCE E. WAGY
Directorate of Aerospace Safety



What do you know about your local aircraft arresting system? If you work in the tower/approach control, base operations, wing flying safety, crash rescue, or base facilities, your job security may depend on your knowledge of the local aircraft arresting systems. If you're a pilot, your life may depend on your knowledge of all aircraft arresting systems.

The following self-test may point out some areas for further study. Be honest! Cover the answers until you've committed yourself.

1. Question: Aircraft arresting systems are designed only for emergency arrestment of aircraft.

A. True
B. False

Answer: This one is easy and was entered only to encourage you. The answer is obviously false. At some bases, certain aircraft (for example, the F-4) routinely make operational arrestments under certain adverse weather and runway conditions. Consequently, the Air Force has reviewed its policy on the use of arresting systems to allow for both operational and emergency arrestments. If your answer was A, a good review of AFR 55-42 is in order.

2. Question: The term used to describe a device used to engage hook-equipped aircraft to absorb the kinetic energy of a landing or aborted takeoff aircraft is:

A. Barrier
B. Cable
C. Big Bertha

Answer: Cable. If you answered Barrier, you obviously were not briefed on the contents of ALSAFECOM 008-76 in 1976. A pilot of an F-111 on an emergency recovery was informed by tower personnel that there were no barriers on the assigned landing runway. The pilot elected to land on a shorter runway that did have a barrier. The tower was correct; the original runway had no barriers. It did have two arresting cables which were what the pilot wanted. For those of you who answered Big Bertha, you are partially correct. It could certainly absorb the kinetic energy and reduce the landing roll if strategically placed on the runway.

3. Question: An aircraft plans to make an approach end cable arrestment on a runway equipped on both ends with a BAK-12 in conjunction with a BAK-14. What should he tell the tower?

A. Raise cable.
B. Barrier, barrier, barrier.
C. Raise cable on approach end.
D. Nothing, the cable is always in place.

Answer: The BAK-14 is a hook cable support system that provides a means to lower the cable below the runway surface to avoid interference with traffic not requiring or capable of using the hook cable.



A pilot request to "raise cable" will mean to raise the departure end cable. An approach end cable must be specifically requested. For those who answered B, go back to Question 2.

4. Question: You are a pilot of a hook-equipped aircraft just short of rotation speed on takeoff roll on RY 32L, Moffett Field CA, when you elect to abort for utility hydraulic failure. The IFR supplement depicts the A-gear thus:

Rwy 14R E5-1→ ←E5-1——E5-1→ RW 32L
(1435') (2545') (1520')

What arresting system(s) can you expect?

A. Two hook-cable arresters, no sweat!

B. A bi-directional BAK-12 type arresting system.

C. A single usable hook-cable arrester 2545 feet short of the departure end.

D. I'm not a dummy. I would continue the takeoff and make an approach end engagement on RW 32L.

Answer: The E5-1 is a Navy unidirectional chain type arresting gear. Answer A is close except for the "no sweat." Only the cable 2545 feet from the departure end is usable on takeoff from RW 32L. If you answered B, study the IFR supplement legend which shows Navy/Air Force equivalent A-gear. Those who answered D may be "smart" to continue the takeoff and make an approach end engagement. However, RW 32L has no approach end arresting system. Answer C is most correct. After deciding to abort, you had best get that tail hook down fast, your only usable barrier is a nominal 5600 feet from the takeoff position.

5. Question: A C-9 is "nordo" on final to a runway with retractable barriers. The barriers should be:

A. In accordance with a letter of agreement.

B. Left retracted

C. Raised

Answer: A is almost correct. Barriers and/or hook cables should be raised for a landing military jet with a known or suspected radio failure or anytime there is doubt regarding the ability of an aircraft to engage the system. Exceptions, however, are authorized for specific aircraft which cannot engage an arresting system such as the B-57, T-37 and large cargo type aircraft, C-9, C141, C-5, etc., if covered by a letter of agreement.

6. Question: What are "Dead-Man Anchors?"

A. Big Bertha used as an arresting system.

B. A device used to anchor a BAK-13 to the earth for expeditionary installations.

C. Chains which are used with MA-1A barriers to absorb the kinetic energy.

Answer: B The BAK-13 arresting system provides operational, rapid cycle recovery of hook equipped aircraft in an austere forward area environment. It is designed as an air transportable expeditionary system that can be quickly installed for operational use.

7. Question: You are a flight leader of a four-ship flight recovering on a runway with a BAK-9 arresting system. The runway is icy so you decide to utilize the barrier. What would be the minimum time from the first engagement to the last. (Hint, the nominal rewind time for a BAK-9 is 3.5 minutes.)

A. 14 min



B. 10.5 min

C. The time required is so long you should go to your alternate.

Answer: Those who answered A get a big "A" for multiplication and a big "hiss" for logic. Those who answered B get an "A" for logic and a "hiss" for falling for the hint. While the hint is true, the BAK-9 arresting system operational recycle time must be limited to approximately 20 minutes due to inspection and cooling requirements.

8. Question: You are approaching to land at Plattsburgh AFB in a hook-equipped aircraft. You request the dual BAK-12 be in the single mode. Which of the following is appropriate?

A. The dual BAK-12 in the single mode configuration is identical to a regular BAK-12 arresting system.

B. All BAK-12's are dual capable.

C. Present Dash One engagement speeds apply, but the engagement should be made slightly off center.

Answer: The dual BAK-12 system consists of two single B-12 energy absorbers installed on each side of the runway connected to a single cross runway arresting cable. The system was designed to arrest the heavier hook-equipped aircraft. The system can be converted to a single mode where present Dash One engagement speeds apply. However, in the dual BAK-12 single mode configuration hook loads are a bit higher than a regular BAK-12. Therefore, the engagement should be made slightly off center which produces hook loads similar to a regular BAK-12 system.

9. Question: A fighter pilot diverting to a USN airfield notes that the IFR Supplement shows E-28 arresting systems. How can he find out what that system is?

A. Why worry? If it's Navy it's got to be good.

B. Call the tower.

C. Look in the IFR Supplement Aerodrome/Facility Directory Legend.

Answer: The IFR Supplement Aerodrome/Facility Directory Legend lists the E-28 as similar to the BAK-13. In an emergency this is probably the easiest way to identify the type arresting system, assuming the pilot knows what a BAK-13 is. At any rate he can determine that the E-28 is a hook/cable bi-directional system. Although the directory lists the B-13 as similar to the E-28, a more thorough investigation would reveal some differences in gross weight/airspeed limitations.

10. Question: Airfield managers should concentrate on ensuring that new barrier installations meet appropriate standards; established installations are obviously correct.

A. True

B. False

Answer: If the question was true, how would I make a safety plug. A review of accidents dating back to 1972 revealed that three accidents were attributed to improper barrier installations, and two accidents were attributed to improper maintenance. All barrier installations should receive periodic safety surveillance.

* * * *

OK, let's check the score. If you were correct on all questions, it's obvious you didn't cover the answers. If you didn't score 100%, there may be more about aircraft arresting systems that you could bone up on. Some good sources are:

Aircraft flight manuals

Arresting system technical orders

FLIP documents

AF Regulation 55-42 (Management and Use of Aircraft Arresting Systems)

ALSAFECOM 008/76

FAA Handbook 7110.65

AFISC Accident/Incident data. ★

OPS TOPICS

SHALLOW APPROACH

Two pilots were making an approach to a local municipal airport in a T-38. Shortly before the aircraft touched down, the rear seat pilot felt a thump and saw an approach light fixture flying away from the aircraft. The aircraft returned to home base where the left brake was found damaged. A call to the muni showed that two approach lights were broken off at ground level. The aircraft did not touch down in the overrun, but because the pilot flew such a shallow approach, the main gear struck the light. This unit has instructed their pilots to shift their aim point from the approach end overrun to the runway threshold, to ensure that the main gear will clear the elevated approach lighting.

THANKS TO AN ALERT CONTROLLER

An F-106 had a total electrical failure while airborne. The pilot was able to remain in VMC and return to his departure base. The Center controller involved observed the loss of the aircraft's IFF/SIF and loss of radio contact and notified the tower of the electrical failure inbound. This allowed tower to coordinate the recovery and have emergency vehicles standing by. The F-106 landed uneventfully, thanks to the controller for his alert response.

IT'S NESTING TIME

While preparing to launch a KC-135, the crew chief saw a bird disappear into the wing. When the crew investigated further, they found a large bird nest complete with eggs in the outboard aileron control actuator. Birds have also taken up residence in propeller hubs, engine bays and other interesting places. This is the time of year to check carefully during preflight.

AILERON ICE

After a night of heavy rain, the pilot arrived at his A-10 for an early morning departure. During preflight the rain had decreased to a light drizzle. After takeoff the A-10 climbed to FL 240 and cruised at FL 240 for the next 2 hours. Then the pilot noticed that the stick was becoming stiff. Although he saw no ice, the pilot suspected ice in the ailerons. It took 20 minutes of selecting alternate controls and movement to free the ailerons. Although maintenance inspectors could find no mechanical problems or water after landing, the most probable cause was water in the flight controls from the heavy rains.

TAXIING ISN'T GOING ALONG FOR THE RIDE!

A cargo aircraft landed and was taxiing at a non-USAF facility. The marshaller's instructions weren't clearly understood by the crew. The crew was concerned that the left wing tip wouldn't clear a parked truck. No sweat! After missing the truck, the crew again tried to follow the marshaller's directions. Nobody noticed the other obstruction approaching the left wing. Tower transmitted a warning on guard, but the crew didn't acknowledge. DENT, SCRAPE, OUCH! The left wing tip was damaged, and needless to say, the crew was very embarrassed. The moral—obvious—if you're not absolutely sure of your wing tip clearance—STOP! Old Chinese saying—careful taxi driver never wreck airplane. —Captain Michael T. Farson, Directorate of Aerospace Safety.

OPS TOPICS

A LITTLE MISTRUST IS A GOOD THING

—The approach controller gave the aircrew a vector that would have headed them straight for terrain. When the crew questioned the heading, they got a vector that lined them up with the runway.

—A GCA final controller confused two aircraft on final approach, and was giving instructions to the wrong aircraft. The crew realized what had happened and took corrective action.

Both of these *actual* occurrences would have ended in disaster if the crew had blindly followed the controller's instructions. A questioning heads up attitude can help an aviator reach a ripe old age. Remember, the guy on the ground is human, and he can have bad days too. Just make sure *you* don't make the error of letting the other guy's mistake kill you. —Captain Michael T. Farson, Directorate of Aerospace Safety.

NOT A HANDGRIP

While flying in a US Army OH-58, a technical observer in the copilot's seat wished to shift position. The aircraft was at a hover at the time. Looking for a handhold, the observer inadvertently grabbed the copilot's collective stick and pushed it down. The pilot was unable to recover before a hard landing occurred. In any aircraft when non-qualified personnel occupy crew positions, the aircraft commander must be absolutely sure these persons understand which controls are not to be touched. This was only a minor incident. It could have been much worse.

CROSSCHECK

While returning from an ATC mission during which the altimeter performed normally, the pilot of an F-15 leveled at what he thought was 5,000 feet. Actually, as pointed out by his wingman, he was at 15,000 feet. The wingman took the lead and they flew a formation approach to landing. Maintenance reported the altimeter malfunction could have gone the other way—a 10,000 feet high indication. This was a daylight mission. What if the altimeter had failed the other way—at night? It has happened many times. Crosscheck is the name of the game. The standby altimeter was functioning properly.

LIGHTNING

McDonnell Douglas Corporation has been involved in lightning research for many years. Included in an article in Vol 24 of MAC's *Product Support Digest*, "The Eagle Looks at Lightning," were some figures and facts that will be of interest and value to USAF aircrews. Here are some selected items. All apply to the Phantom.

- 43 percent of lightning strikes occurred in clouds, 57 percent while adjacent to clouds.
- 83 percent of reported strikes occurred during rainy conditions.
- 36 percent involved F-4's at altitudes up to 5,000 feet, the other 64 percent scattered out at 10 to 20 percent increments up to 25,000 feet.
- Damage ranged from negligible skin pits to the loss of an entire rudder, release of bombs and loss of external tanks. Canopy strikes caused flash blindness of up to 30 seconds.

The months of March through July are the busiest lightning months. ★

mail call

Send your comments and questions to:
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AFISC/SEDA
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REVISION OF "IFC APPROACH" ARTICLES

1. We compliment you for the professionalism of "The IFC Approach" articles. Your sustained accuracy makes this column the standard technical authority for instrument flight.

2. There were two errors in the January 1977 column, however, which I believe should be brought to your attention. "Post 20, DESCEND NOW TO . . ." should read, "Post 20, DESCEND AND MAINTAIN . . ." and "ADVISE YOU CLIMB TO (ALTITUDE) IMMEDIATELY.", should read, "ADVISE YOU CLIMB AND MAINTAIN (ALTITUDE) IMMEDIATELY."

3. As a rule of thumb, pilots should not expect to hear the word, "TO", followed by numerals. The words "TO" and "TWO" can cause confusion. The only exception is, "DESCEND/CLIMB TO REACH (ALTITUDE)."

BRINSON N. LEAPTROT, Colonel, USAF
DCS/Air Traffic Services
HQ Northern Communications Area (AFCS)
Griffiss AFB, NY

ERROR IN RSC AND RCR ARTICLE, JAN 77

1. First of all I want to say that I was very pleased to see my article RSC and RCR published in the January 1977 issue of **Aerospase Safety.** The pictures you added to the article were very appropriate and contributed significantly to the value of the article.

2. Secondly, I would like to point out one error that appeared in the article. The example "SLR16P—Dry slush on . . ." was in error. It should have read "SLR16P DRY—Slush on . . .". This small mistake changes the true meaning of the RSC/RCR report and, if possible, a correction should be published.

DAVID L. BUZARD, SMSgt, USAF
Mgr AWS Surface Observing Program
Field Support Dir, DCS/Operations
Scott AFB IL

U-2 PILOT OPENINGS

There are current manning requirements for highly motivated, mature and experienced pilots for entry into the U-2 Program. This is a special duty assignment as stated in AFR 36-20. The aircraft is flown to absolute limits in a pressure suit environment, demanding very highly skilled and dedicated pilots. Minimum requirements are:

a. 1500 hours total flying time, of which 1000 hours are jet.

b. Diversification to include pilot in command experience in two or more types of military aircraft.

c. Medically qualified to fly the U-2.

d. Others as stated in AFR 36-20, Chapter 8.

If you qualify and are interested, please contact a U-2 Manning Project Officer, AUTOVON 368-2927/2156.

MAKE STATISTICS A TOOL—NOT A RULE

Several years ago, the Directorate of Aerospace Safety hired a group of people to analyze and predict where the mishaps would occur. The early test results were quite good—too accurate in fact—so in 1977 they've let us all in on the forecast.

1977 Mishap Forecast*	
Control Loss (Pilot)	8
Collision with Ground (Nonrange)	8
Collision with Ground (Range)	6
Midair Collision	6
Landing (Pilot)	12
Takeoff (Pilot)	3
Locally Preventable	43

*Includes all class A, but only class B mishaps with losses greater than $50,000.

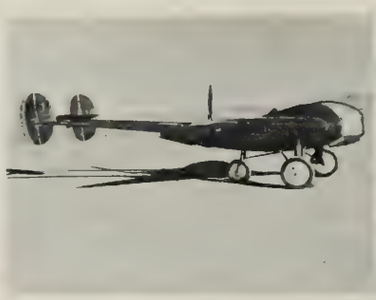
Your local safety officer has detailed information on the forecast. Ask him to help you develop your own prevention program.

We're out to prove the forecasters wrong and you'll see a lot of activity in this area—movies, video-tapes, magazine articles, safety officer training, etc.

The stakes are high—lives, equipment and combat capability—but now that we know, we should be able to do something about it.

Make everyone happy—prevent a mishap.

NAME THAT PLANE





This forerunner to a famous class of aircraft first flew at Muroc Dry Lake CA in the 1929-1930 period.

☆U.S. GOVERNMENT PRINTING OFFICE 1977 789/855/44

TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



SQUADRON LEADER

Malcolm Gleave ROYAL AIR FORCE

319th Fighter Interceptor Training Squadron

Tyndall Air Force Base, Florida

On 2 June 1976 Squadron Leader Gleave, an F-106 flight instructor and Captain Laszlo J. Bakonyi, a weapons controller, departed Tyndall Air Force Base in an F-106B on a tactics development test flight. The mission proceeded normally until the last intercept which required a final turn at a 60 degree angle of bank with afterburner selected. As the afterburner ignited, the crew heard a thump and noted the gear unsafe light had illuminated. Sq Ldr Gleave immediately reduced airspeed and requested the target aircraft (GP-24) join up and visually check for any damage. GP-24 reported that part of the left main gear door was missing, but that the left landing gear itself appeared normal and no other damage to the air frame was visible. Sq Ldr Gleave declared an emergency and began an RTB with GP-24 in formation. At approximately 10 NM from base, when normal landing gear extension was attempted, only the nose gear extended. Using the emergency extension system, Sq Ldr Gleave was able to lower the left main gear, but the right main remained retracted. A closer check by GP-24 revealed that the right main door was open several inches. Attempts to lower the gear by yawing and rolling the aircraft with rapidly applied positive G loading to about 3½ Gs produced no results. After all attempts to lower the gear proved futile, Sq Ldr Gleave decided on a midfield arrestment on runway 13 Left. It was foamed, beginning 500 feet prior to and extending 2500 feet beyond the barrier. In an effort to maintain airspeed and directional control, to prevent the right wing and external fuel tank from contacting the runway, he did not deploy the drag chute. The cable was engaged on centerline at approximately 130 knots with the nose gear and right wing barely in the air. Immediately after cable engagement, the nose came down, breaking the nose gear strut and crushing the right drop tank. At approximately 500 feet runout, the cable broke and the aircraft veered sharply to the right, finally exiting the runway 1500 feet after cable engagement. The aircraft entered the soft soil at the runway edge and came to a stop approximately 90 degrees to the runway heading. Both crewmen egressed safely. Despite the adverse conditions, Sq Ldr Gleave's superior judgment, decisive action and exceptional pilot skills were responsible for successfully recovering an irreplaceable aircraft with only minor damage. WELL DONE! ★

"Radar contact" may not mean what you think it does. Radar Myth — Conceptions can cause you real trouble (Page 20).

aerospace

SAFETY MAY 1977



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From a drawing by R. Mahoney.
Courtesy Air and Space Museum.

MAY 1977

UNITED STATES AIR FORCE

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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NAME THAT PLANE

THE KEYSTONE B-3

This aircraft had a wingspan of 74 feet 8 inches and a gross weight of more than 12,950 pounds. It was powered by two 525 hp air cooled radial engines.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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MAY 1977 AFRP 127-2 VOLUME 33 NUMBER 5

The Heritage of Lindbergh



Fifty years ago—on 20 May 1927, a slim, boyish young man took off from Roosevelt Field, New York, in a single-engine monoplane with no radio, without a parachute, and only the most elementary of navigation instruments to fly the Atlantic Ocean solo. Covering some 3600 miles, he landed 33½ hours later at Le Bourget Field, Paris, France, to a wild celebration and fame that changed the rest of his life.

The young man was Charles A. Lindbergh. His accomplishment opened an era of growth in aviation that has resulted in supersonic flight and men on the moon. Technology and engineering have taken giant steps forward. Engines and air vehicles today routinely accomplish missions that were unthought of 50 years ago. Complex navigation equipment and highly sophisticated computer techniques have permitted us to fly a space probe for almost a year and, having reached Mars, to selectively and with great care choose a precise place and effect a safe landing. The vision, dedication, devotion and sacrifice of many have made these unbelievable happenings come true.

In the military we have seen the airplane become one of the most flexible and powerful tools. But as with any evolving system, there were losses due to accidents. In 1947, the year the Air Force became a separate service, we experienced 2282 aircraft accidents which accounted for 584 fatalities. Contrasted to that experience, in 1976, the USAF had 108 accidents and 118 fatalities.

Technology and engineering played a role in these achievements, but the most significant factor has been man himself. Our commanders, operators, supervisors and maintenance personnel have teamed with the engineers, program managers, logisticians and the safety staffs to make Air Force operations the most effective, ready and safe in the world today.

As we continue that era opened by Charles A. Lindbergh some 50 years ago, I commend each one of you for your dedicated service and hard work and urge you to even greater heights of achievement, that this great land of ours may continue to remain free and strong. ★

William V. McBride

WILLIAM V. McBRIDE, General, USAF
Vice Chief of Staff

MSgt DAVE SYLVA
63 MAW, Norton AFB, CA

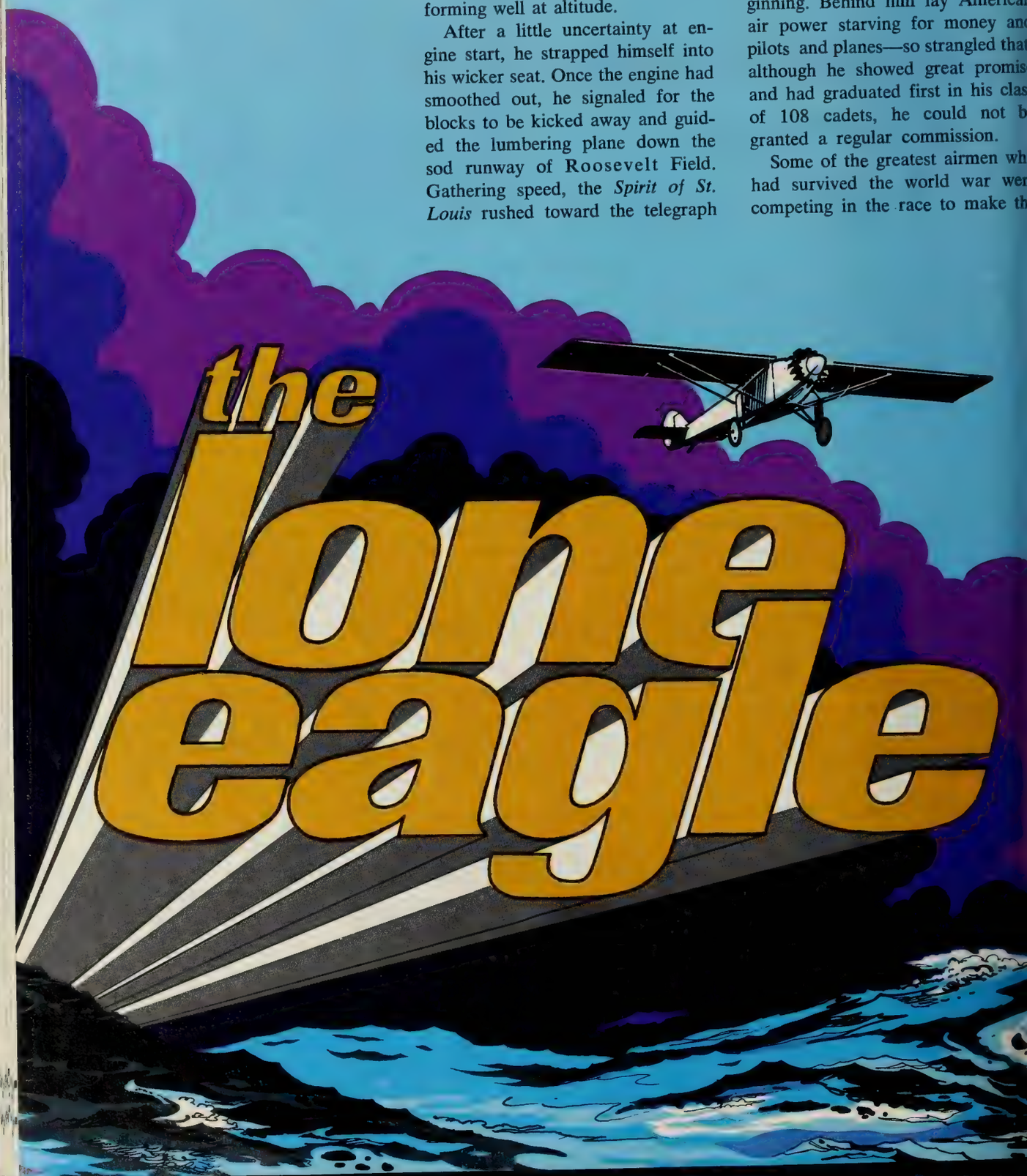
the lone eagle

What would become of him? The odds were certainly against him. At least four previous attempts at the transatlantic, non-stop record had ended in disaster and death. Now it was his turn. The weather was bad and in mid-ocean it would be worse. His Ryan monoplane was as yet unproven and the engine was not performing well at altitude.

After a little uncertainty at engine start, he strapped himself into his wicker seat. Once the engine had smoothed out, he signaled for the blocks to be kicked away and guided the lumbering plane down the sod runway of Roosevelt Field. Gathering speed, the *Spirit of St. Louis* rushed toward the telegraph lines and trees at the end of the field. She bounced several times and shuddered into the air. Lindbergh was on his way. In the next 33 hours, the world would leap ahead 50 years or more.

Behind him lay the world of the barnstormer . . . the wing-walkers parachutists and county fair spectacles that had given Lindy his beginning. Behind him lay America air power starving for money and pilots and planes—so strangled that although he showed great promis and had graduated first in his class of 108 cadets, he could not b granted a regular commission.

Some of the greatest airmen wh had survived the world war wer competing in the race to make th



first non-stop flight across the Atlantic Ocean.

French ace Captain Rene Fonck had crashed on takeoff killing two of the four crewmen aboard in a September 1926 attempt. In April, two more attempts ended in disaster. First, Commander Richard Byrd, who planned the navigation of the Navy's transatlantic flight of 1919 and who would later gain greater fame as an explorer, crashed on takeoff injuring all of the crew except the plane's designer, Anthony Fokker. Ten days later, Lt Commander Noel Davis and his co-pilot drowned when their Martin "Keystone" bomber flipped over in a marsh.

On May 8, 1927 another great French ace, Charles Nungesser and his navigator, Francis Coli were last seen passing the Irish coast on a Paris to New York bid. They died in, or above, the black green waters of the North Atlantic.

If these great men in their proven machines could not conquer the air, what would become of the tall, young and serious looking airmail pilot in his unconventional Ryan monoplane?

Neither an idealist nor a military strategist, Charles A. Lindbergh was putting it all on the line for the fame and the prize money. ($25,000 being offered by a New York hotelman for the first non-stop flight between France and New York.) Others were watching though. Some for the thrill of adventure, some from morbid curiosity, and a few, the "sons of the prophet," watched for vindication of air power.

It was only a year or so earlier, on December 17, 1925, that Colonel William L. Mitchell had been found guilty by a General Courts Martial. Guilty as charged, he had made public statements that were disrespectful, insubordinate and prejudicial to good order and military discipline.

Mitchell had watched as the Air Service was slashed in manpower and appropriations as soon as the first World War ended. Men died in the crashes of their obsolete and unsafe airplanes. Most galling, Mitchell believed that the US was open to attack by enemies who understood and used the air power that he was trying to develop for our own defense.



Photo courtesy 1361 AVS.

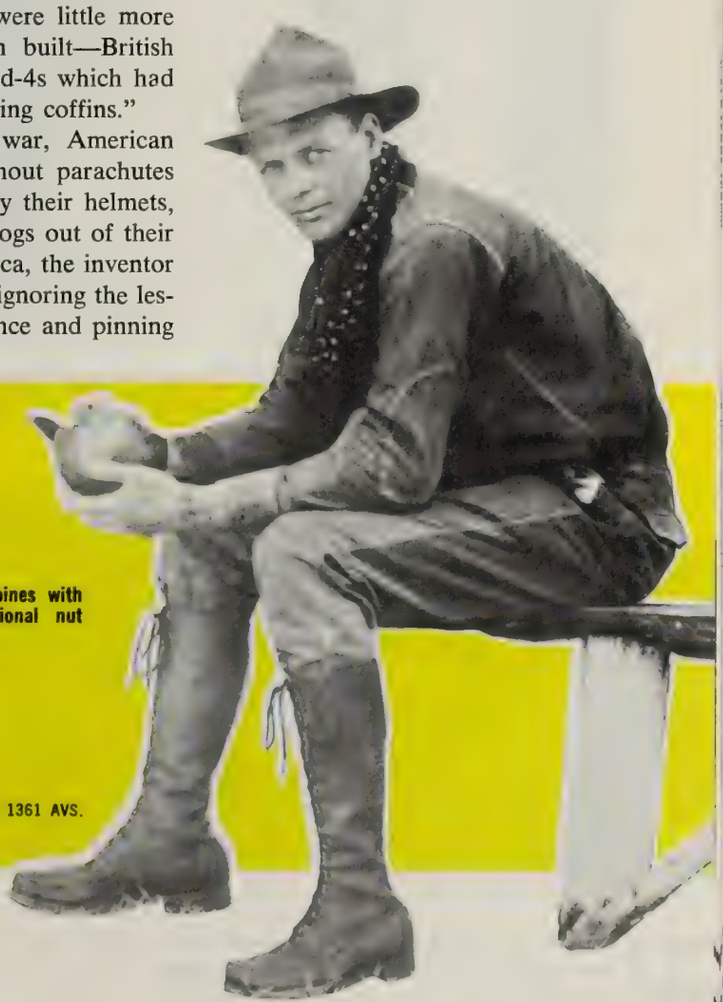
Capt Charles Lindbergh just before the take off from San Diego on the only test flight prior to his transatlantic attempt.

The American Air Service in the great war had flown in French and British airplanes. America's personal contributions to the air war, besides her pilots, were little more than 150 American built—British designed DeHaviland-4s which had been branded "flaming coffins."

Years after the war, American pilots still flew without parachutes and even had to buy their helmets, goggles and flying togs out of their own pockets. America, the inventor of the airplane was ignoring the lessons learned in France and pinning her entire defense on the surface ships of the United States Navy.

On April 28, 1941, the same day that the German Army marched into Athens and just seven short months before Pearl Harbor, Charles A. Lindbergh, Jr., resigned his commission as a Colonel in the Army Air Corps Reserve.

The United States appeared on a collision course with war. Lindbergh believed it was a European



Lindy in the Philippines with sample of the national nut (coconut).

Photo courtesy 1361 AVS.



Above, Charles A. Lindbergh and Col Harry Graham before takeoff from Rockwell Field. Below, Rockwell Field, 10 May 1927. Photographed by Mrs. Laura May McGuirk, Rockwell employee.



Photos courtesy AF Air Museum.

The Lone Eagle

matter and that we were unprepared, in any case. A totally honest man, he accepted what he had been told and what he had seen with his own eyes. The storm clouds of a European war were gathering, everyone knew that . . . but Lindbergh had been there and to him the outcome was already decided.

At the invitation of Hermann Goering, Lindbergh toured Germany and met with its aviation leaders, including Generals Udet and Milch, and with the designer Willy Messerschmitt. He flew over and toured many of the 500 pilot training centers at a time when the British had a mere 12 and the United States only three.

During the European visit, he was told personally by the French Air Minister that the French Air Force was obsolete and capable of producing only 45 new planes each month and the British, 70 or so. When told this, Lindbergh was already aware that Germany was producing 800 new warplanes every month. In fact, on the day the sixth British "Spitfire" rolled off the Vickers-Armstrong assembly line, there already were 2,000 Messerschmitt 109s operational in the Luftwaffe.

Not a Nazi, but awed by what he had seen of German technical skill and infuriated by what he perceived to be British indifference and French incompetence toward the threat, Lindbergh joined a movement called "Defend America First." He made public appearances pleading for America to stay out of the coming "European" war.

Diametrically opposed, President Franklin D. Roosevelt publicly accused Lindbergh of "defeatism" and characterized him at best a "sunshine patriot" and at worst a "Copperhead." Lindbergh's sense of personal honor and integrity left him no alternative but to resign his commission.

Pearl Harbor settled the isolation vs. involvement issue. Lindbergh,

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Photo courtesy AF Air Museum.

New York City—June ticker tape parade in honor of Lindy, one of the biggest in New York's history.

still believing that we were in the wrong war, but wanting to do his part, offered his services to the Army Air Corps. Although encouraged by "Hap" Arnold to press the issue, Lindbergh was given little encouragement by the Secretary of War. Secretary Stimson said that Lindbergh might assist as an advisor but ruled out any position of command. President Roosevelt would have to personally approve any appointment and feelings of ill-will still existed between the flyer and the president.

Fearing that he would be shunted into a meaningless, sideline job, Lindbergh withdrew his offer and returned to civilian aviation. He was a civilian (with his country at war) but he was far from the sidelines.

Working out of Ford's Willow Run plant near Detroit, he was as deeply involved in the war as anyone could be. He flew the Army acceptance tests of Consolidated's B-24 *Liberator,* and nearly killed himself flying the high altitude tests of Republic's magnificent jug, the P-47 *Thunderbolt.* Then, fate gave the nod to Lucky Lindy. In a new job as chief test pilot for Chance Vought on the F4U *Corsair* project, he worked a deal with the Navy to go to the southwest Pacific as a technical representative for his company. His job would be to offer assistance and advice, to look into problem areas (one of which was the Corsair's occasional but nasty habit of folding its wings on take-off) and to get consumer views on ways to improve the design.

Three years to the day after Lindbergh resigned his commission, he was passing through Hickam Field, Hawaii on his way to war. While on that "inspection tour" Lindbergh flew 178 combat hours racking up 50 missions over some of the worst targets in the war zone including Rabaul, the worst of all. The missions were as varied as a pilot could hope for. Bomber escort, strafing, bombing, RESCAP (Rescue Combat Air Patrol), and some honest-to-God air-to-air combat with zeroes.

Although sent out by Chance Vought, with both War and Navy Department blessing to see what could be done to improve the Corsair's performance under combat conditions, Lindbergh changed his plans enough to get in some combat time in the Lockheed P-38 *Lightning* with Kenney's Kids out of Hollandia, New Guinea. He flew as an element leader in the 475th Fighter Group on missions with Tommy McGuire and Charlie MacDonald. While he was at it he managed to get a kill and, almost by accident, stretched the range of the P-38.

Like any of the pilots who had flown the airmail, Lindy was fuel conscious and had just automatically adjusted his settings. By decreasing the rpm and increasing the manifold pressure, he was able to maintain speed with the formation. They came back to base, he with tanks half full while the others were sucking fumes. He shared this bit of knowledge with his friends and, in doing so, practically created a new airplane.

A civilian? Definitely! But on the sidelines? Absolutely not! Regardless of his pre-war views, Lindbergh had come to his country's defense in his own way . . . in the best way he could have. As a civilian Tech Rep he enjoyed freedom of movement and freedom of decision. As a respected flyer he lent his name, his stature, and most importantly,

"We" arrives at France Field. Canal Zone.
Photo courtesy AF Air Museum.





Photo courtesy 1361 AVS

Lindbergh appears to be the epitome of confidence in this photo during visit to a military base. Contrast this with the shy appearing young flyer ready to challenge the Atlantic.



Photo courtesy AF Air Museum.

While in the Pacific Theatre Lindbergh's flying skill earned the respect of aces like Mayor Thomas McGuire.



Photo courtesy 1361 AVS.

Lindbergh, left, with Brig Gen Robin Olds.

his skills to the American war effort.

Lindbergh. The name was magic to young pilots who were waging the air war in the Southwest Pacific. And why not? America's "Lone Eagle" was probably the most adored and admired hero of his time. Just 17 years had passed since he had won immortality as the first man to fly non-stop from New York to Paris.

The immortality was not earned by being first to do it. The glory of Lindbergh's flight was that he had done it alone. Others in competition for the honor and the $25,000 prize had planned their flights with supporting crews and multi-engine planes. Lindy flew alone in a single-engine plane of unproven design.

Thirty-three and a half hours after taking off, at nearly 10:30 p.m. on the 21st of May, 1927, the *Spirit of St. Louis* slipped in to land at Le Bourget airport in Paris. Flying alone for a day and a half, Lindbergh made the 3,600 mile trip with fuel to spare. He had flown 1,000 miles in the ugliest weather of the North Atlantic. Like Columbus before him and Neil Armstrong 40 years after him, he changed the map of man's world. More than that, Lindbergh changed the mind of man.

Mitchell and the other prophets of airpower were vindicated. The airplane was not a novelty, either in the civilian or in the military sense. The oceans were not the barriers they had been, either to international culture or to aggression.

From the Lindbergh flight onward, even the most fundamental thinkers would have to admit, however grudgingly, that airpower was a force to be reckoned with. After the flight, requests for appropriations for research and development of the Air Corps would not be rejected out of hand.

It did not happen overnight. There would still be years of frustration and sacrifice ahead for the men who were trying to give this country an Air Force. Because of what Lindbergh did, though, our entire concept of national defense would be altered.

In return for his life-long gift of accomplishment, inventiveness, support and advice to American air power, President Dwight D. Eisenhower appointed, and the Senate confirmed, Charles A. Lindbergh a Brigadier General in the United States Air Force Reserve.

Lindbergh's achievements inspired a nation and helped to weave the fabric of today's Air Force. ★

HEADS UP

Midair collision prevention, of major concern to all in the aviation community, is creating a large, sophisticated effort. This article deals with an effective but simpler method for use in VMC.

CAPTAIN RICHARD P. MARTIN
USAF Instrument Flight Center
Randolph AFB, TX

A recently published National Transportation Safety Board (NTSB) summary of recommendations on midair collision prevention reminded us that each year the risk of midair collision increases. Reviewing their recommendations as listed in the 28 January 1977 *TIG Brief*, it is apparent that perhaps much of the emphasis in the way we fly may be in the wrong direction. For example, one recommendation reads, "Develop and publish standards for visual search techniques to be used when pilots are operating in visual meteorological conditions." Many pilots feign clearing, but we should reevaluate how really serious we are about it.

We all know that it is easy to become preoccupied with correcting minor flight parameter deviations (altitude, airspeed) when in visual conditions (ants) and ignore the very real dangers that exist such as small VFR aircraft in close proximity (elephants).

Chapter 8 of AFR 60-16, *Instrument Flight Rules (IFR)*, begins with, "THE AIR FORCE GOAL IS MAXIMUM AIR OPERATIONS UNDER IFR. MAJCOMs will establish procedures to insure that all flights are conducted under IFR to the maximum extent possible without unacceptable mission derogation." Notice that it does not say, "FLY THE GAUGES TO THE MAXIMUM EXTENT POSSIBLE." The discussion continues with, "Pilots operating in visual conditions under IFR should be aware that they are in a 'see and avoid' environment. Separation is provided only from other *known* aircraft operating within CONTROLLED airspace."

When we are flying for instrument proficiency, an instructor or other observer is generally clearing for us. However, too many of us during normal, everyday, operational flying probably spend too much of our time "in the cockpit" when in VFR conditions. No doubt many aircraft fatalities have been the result of such a practice. It seems to be getting harder and harder to break the instrument yoke.

In the Stone Age, before attitude indicators were invented, pilots maintained their position in the air by what they saw outside. I doubt if too many of them unknowingly flew into their neighbor's chicken coops. How many of today's pilots

consciously use outside visual references, except perhaps in the VFR traffic pattern? How many think about using outside references for maintaining altitude, heading and bank or are even remotely interested in knowing how? If the answer is few, it may be due to the common misconception that instrument flying is "where it's at," prevalent among large aircraft aircrews, or may be due to the checkride syndrome.

Generally, too many crew members and evaluators are overly concerned about flying within "X" knots of airspeed, "X" degrees of heading, and "X" feet of altitude while being observed. They feel that the best way to impress whoever is looking over their shoulder is to be as close to all flight parameters as possible. Unfortunately, in many cases they are correct. Many people are impressed by this type of performance and place little emphasis on a pilot's awareness of how close he is to all other traffic in his area of operations.

Yet, how many aircraft and/or lives have been lost because a pilot was 10 knots off his airspeed or 100 feet off his enroute altitude? How many have been lost due to midair collision? How many have ALMOST been lost due to midair collision? How many pilots have flown a sound aircraft into the ground in VFR conditions? If you don't think this is a problem, check the NTSB statistics on "controlled collisions with ground/water."

If we are to change the emphasis from "precise maintenance of all flight parameters" to "total professionalism in all flight conditions," priorities will have to be rearranged in three areas: flight examination, flight instruction, and plain, garden variety flying. It is vital for flight examiners to emphasize collision potential awareness, whether it be collision with airplanes or civic auditoriums, and deemphasize the measurement of a pilot's abilities by how well he nails down his flight instruments on a flight check in visual conditions. What we need is more "pilotage." And pilotage, as an art, probably needs more emphasis in all our flying programs.

Next, instructors must be able to teach pilots to operate comfortably in an "outside reference" environment, and make sure they know when the situation calls for such techniques. Last, the pilot, in the operational environment, must take the responsibility and initiative to become involved in the airspace in which he is operating. Review of terminal area graphic notices published in the Airman's Information Manual (AIM) will provide insight to the terminal traffic flow.

Air Traffic Control does not guarantee separation between IFR and VFR aircraft (except in positive control airspace) or even aircraft and mother Earth. (Editor's note: FAA has started installation of a low-altitude warning system at their ARTS III terminal radar locations. Approach Controls at Los Angeles, Dulles, Detroit, Denver, Houston and St. Louis have automatic alerts when aircraft descend below a safe altitude—price of admission is a transponder, with altitude reporting, squawking an appropriate discreet code. All ARTS III sites are scheduled to be equipped by mid-1977.)

FAA Handbook 7110.65, Air Traffic Control, states that the controller has complete discretion for determining if he is able to provide or continue to provide an additional service such as traffic advisories in a particular case. The controller's reason not to provide or continue to provide such service in a particular case is not subject to question by the pilot and need not be made known to him. In short, the pilot must use some VFR composite flight techniques anytime flight conditions are VFR, even while using an autopilot.

VFR and IFR flight use similar concepts. Maintaining IFR means adhering to IFR altitudes and airspeeds, while remaining within defined airspace, such as the enroute structure or terminal area and making the most of any traffic separation service available. When VFR, we still remain within certain airspeed, altitude and area parameters, such as in the traffic pattern. On a VFR flight plan, we are expected to adhere to VFR hemispheric altitudes. They are different from IFR hemispheric altitudes but are to be maintained nonetheless.

For specific aircraft, instrument approaches are flown at specific altitudes, airspeeds and bank angles. VFR traffic patterns are flown within similar parameters. The difference is that VFR control parameters are maintained primarily with outside references, or at least should be. The reason that they should be is to keep aircraft clear of other aircraft, condors and tall pine trees. In the VFR traffic pattern, most pilots position themselves with a visual relationship to the runway, both horizontally and vertically. If anyone can think of any reason why we shouldn't maintain our position visually, when possible, on an IFR clearance, let's hear it. The kicker is that we are better off looking outside than in-

side when it comes to maintaining flight parameters.

The horizon, our main visual reference, has two significant advantages over any attitude indicator. It is quite large and it has never precessed, although sloping cloud banks may present the illusion that it has. Because of the horizon's size, a one degree change in pitch will appear quite large when made against it.

As an exercise, pick any reference in the cockpit which aligns with the horizon when in level flight such as the magnetic compass, or a mark on the windscreen. Make a pitch change which changes that reference by one inch. The change on the attitude indicator will be almost imperceptible. A change of reference against the horizon can be made more precisely than a change of reference against most attitude indicators. The net result of more precise pitch is "smoothness" and a resultant airspeed stabilization. A result of smoothness is a tendency to relax. When aircraft control smooths out, so do nerves.

Students enrolled in the Instrument Pilot Instructor School have found that, while making pitch changes using this technique, altitude can be easily maintained, usually within ±20 feet with virtually no effort. Another result of making pitch changes on the original "Earth" attitude indicator is that trim becomes natural almost to the point of being subconscious. With so large a reference, a precise pitch can be maintained while the control pressure is trimmed off to zero. With pitch oscillations held to a minimum, required power changes become fewer. With fewer pitch and power changes, trim changes almost disappear. Sound too good to be true? Try it.

A technique for maintaining heading is to pick a point on the ground and simply fly to it. Nothing new here. We've all heard that technique before, but how many of us use it now? If a radar controller assigns a heading 60 degrees to the left of present heading, simply pick a point on the horizon about 60 degrees from present flight path and turn to it. You will more than likely find some easy cockpit reference for 60° left or right. Pilots who try this may be surprised at how close they can come to the correct heading. If they are consistently rolling out past the desired heading, then an occasional cross-check of the heading indicator should assure the desired heading is not missed.

The point is that nothing constructive is accomplished by staring at the heading indicator while it passes through 60 to 90 degrees of heading change. If the urge to stare cannot be overcome, try staring at the sky. Perhaps a flock of geese won't need to terminate their mission because your aircraft has intruded on their airspace.

Bank angle can also be easily maintained. Set 30 degrees of bank, or whatever bank suits your mission, establish level flight and find a good cockpit reference which meets the horizon. If the same seat height can't be assured on every flight, pick new references each flight. They won't be that different. The end result is relaxation and a new awareness of what is happening outside.

There are many attendant visual scanning techniques which make it easy to spend a great deal of time looking out for whatever dangers may be there. Air Training Command publishes several in their instructor study guides, such as performing in-flight checks, one item at a time with a glance outside between each, and scanning appropriate flight instruments and interpreting what is seen while looking out. Perhaps some of you out in the field have similar techniques. If so, put out the word.

As was pointed out in the 28 January 1977 *TIG Brief,* all of our crewmembers must be trained to time share between cockpit duties and visual scanning for targets, airborne or otherwise. They also must be convinced that they won't get hammered for small flight parameter deviations in the meantime. If they are taught to fly *outside,* they won't deviate that much, anyway. The time to get started is now. Some techniques have been mentioned here. There must be more. Perhaps some of the best ones are in your home squadron. Think of what we are really trying to do. We are flying airplanes. We want to fly them safely. We don't want to bend our sheetmetal or anyone else's.

When in the clouds, we need the gauges. That's all there is. When out of the clouds, the best gauge is outside. As a simile, if you are floating in the middle of the ocean, a good life preserver is great. When you get picked up, it isn't needed anymore. You may hang on to it, though. That boat that picked you up might sink. Instrument proficiency is inherent in the wings we wear as pilots. It is a valuable aid when we need it. It may be an unnecessary encumbrance when we don't. Heads up. ★

IMPROVE THE ODDS

MAJOR PHILIP M. McATEE
Directorate of Aerospace Safety



What would you say if you could reduce one category of mishaps by 25%? Think that is impossible? Well there is a category—landing mishaps—where we could do it!

The AFISC mishap forecast for CY 1977 predicts 12 pilot induced landing mishaps during the year. As writer/philosopher George Santayana said, "Those who cannot remember the past are condemned to repeat it." In order for us not to repeat ourselves, we must look to the past for clues to guide our effort to meet our reduction goal.

A review of all pilot induced landing mishaps during the period June 1975 to February 1977 has yielded some interesting statistics. In our sample period there were 31 mishaps that fit our pilot-induced damage over $50,000 category. Now in order for the number 31 to have meaning, we must consider that there were more than 4 million Air Force landings (exact landing figures are not available) during the same time frame. ATC alone makes over 100,000 landings per month.

That means AF-wide there was less than one landing mishap per 100,000 landings. Now that looks like we are doing pretty well. If we are doing that well, how can we expect to achieve a 25% reduction in our 12 predicted landing mishaps? To see what is necessary for us to do to achieve this, let's review some mishaps over the past two years to see what they have in common:

• A T-33 was practicing a simulated flameout pattern. Shortly before rolling out on final, the pilot selected full flaps. Then the IP requested full throttle. At approximately 50 feet above the ground, the IP raised the flaps in an attempt to stretch the glide. The aircraft struck the ground 630 feet before the runway. CAUSE. The instructor pilot did not make a go-around before the pilot got the aircraft into a position from which recovery was questionable!

• A T-33 was on a student transition flight. After practicing simulated flameout approaches, the pilot entered downwind for a no flap touch and go. The pattern was normal until the T-33 was approximately 3700 feet from the runway. The aircraft struck the ground 156 feet short of the runway. CAUSE. The instructor pilot failed to closely monitor airspeed and failed to take command in time or initiate a go-around when low airspeed and high sink rate were established.

• An F-106 was practicing approaches, after completing night intercepts, when the pilot noticed a fuel imbalance and requested a full stop. His wingman was flying



a loose formation when, at two miles on final, he went around. The mishap pilot was distracted, and misread VASI indications. The aircraft hit short or struck a 9½ foot mound on the end of the runway. Although the pilot immediately executed a missed approach, the aircraft landing gear was badly damaged and he ejected. CAUSE. The pilot failed to execute a missed approach in time when his concentration was broken for the approach.

• An RF-4 was on a formation landings sortie for a student due to a previous unsatisfactory ride. The mission was normal until a formation GCA approach with the IP in the back seat demonstrating a formation landing. As the two aircraft came over the overrun, the mishap aircraft drifted to the right and touched down off the right side of the runway. CAUSE. The front seat pilot failed to take action to call for a go-around when he realized the aircraft would not touch down on the runway.

• An IP was demonstrating to a student a circling approach in a T-38. The IP rolled the aircraft out on final ½-¾ mile from the runway at 600-800 feet. The final approach was steeper than normal with a high rate of descent. The IP tried to add power to extend the touchdown point and slow the rate of descent but it was too late. The right main and nose gear failed immediately upon touchdown. CAUSE. The IP failed to initiate a go-around when the aircraft got too close in and too high on final to permit a safe landing.

The preceding mishaps have one thing in common: **a go-around when the approach did not go as planned probably would have averted the mishap.**

Let's go back to our prediction of 12 pilot induced landing mishaps for 1977. At least **three** could have been prevented if **all** pilots would **always** make a missed approach and try it again if, at any point, the approach or landing is not going as planned. Don't try to stretch that touchdown point! Don't try to recover that bad approach.

Any pilot can end up with an unstable approach for a multitude of reasons—wind shear, unstable speed, too high a sink rate, distractions, weather, etc! The reasons are many but the solution is the same. Take it around and try again.

Let's all try and make our prediction of 12 landing mishaps be wrong on the pessimistic side.

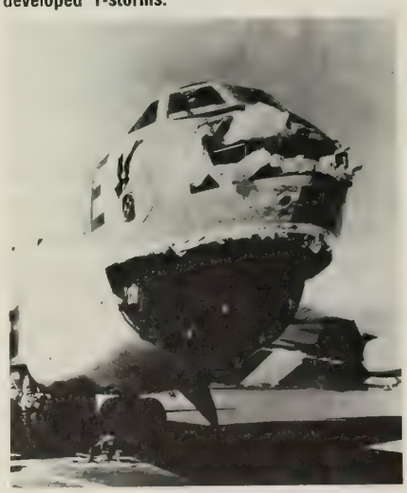
Whenever the approach is not going to your liking, taking it around and trying again can improve **your** odds of not having a landing mishap.

Now how can you pass up a deal like that? ★

DETOUR T-STORMS



T-39 (above) and B-52 show damage sustained in hail encounters. Hail, ice, water, intensive up and down drafts are characteristic of well developed T-storms.



The most powerful engine we have is as but a speck of salt in the ocean when compared to the greatest engine on this earth —the thunderstorm. An awesome package of violent winds, ice, hail and rain, at the height of its power it is capable of destroying any aircraft whose crew is imprudent enough to penerate it.

Long ago pilots learned to respect severe weather simply because they had to. They didn't have airplanes that could routinely fly above most weather. They didn't have radar to help avoid danger areas. They didn't have the weather and air traffic support we take for granted today. In fact, we have so much going for us that we must guard against becoming complacent and fail to respect—and fear—those giant engines in the sky.

For the past three years we have averaged six weather related accidents per year. Very few of these have involved thunderstorms, but one which did resulted in a catastrophe. A C-141 disintegrated in the air after penetrating a thunderstorm. The aircraft was in an area of several thunderstorms and its airborne radar had failed. The air traffic controller had told the pilot that there was a solid wall of severe weather between the aircraft and its destination and that he couldn't see any way around it. Shortly afterward, the aircraft evidently encountered extreme turbulence and broke up in flight.

That was the only accident of that type that the Air Force has experienced in recent years, but there have been several air carrier accidents. In 1975 an Eastern Airlines B-727, driven downward by the force of a violent downdraft, struck the approach lights, 2400 feet short of the runway, at Kennedy Airport, New York.

The aircraft was one of 14 which landed or attempted to land within a 25 minute period during the busiest time of the day—1545 to 1610. The other flights experienced from none to serious problems. Most reported some windshear and rain. All of the aircraft passed through a portion of a small but extremely violent thunderstorm cell. The accident aircraft's misfortune was to fly through the center of the cell at an altitude and landing configuration that made it most vulnerable.

Other aircraft experienced similar difficulties but circumstances were enough different that they were able to avoid an accident. The airspeed of one aircraft dropped 25 knots,

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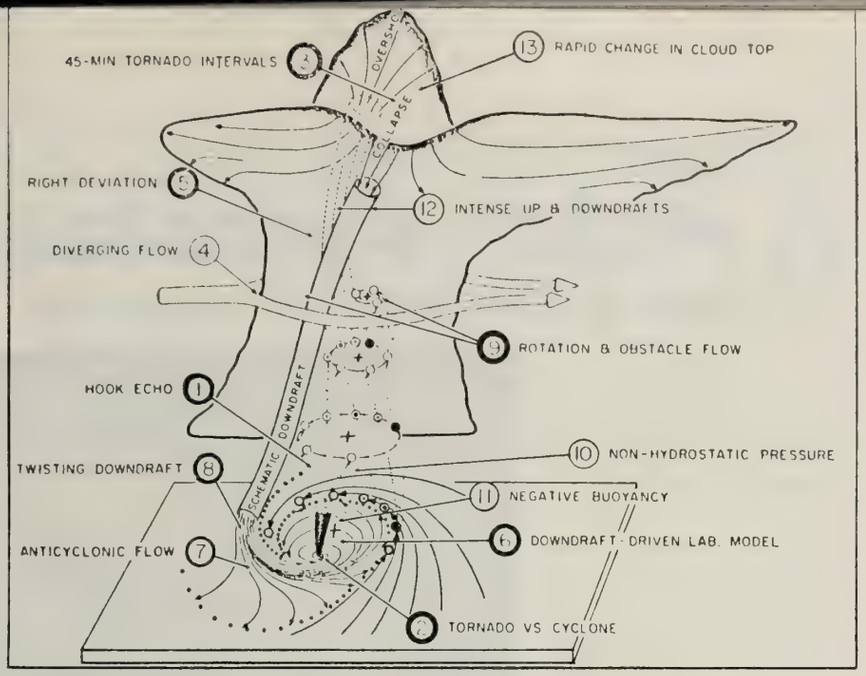
another 20 knots. Airspeed of the accident aircraft decreased from 138 to 122 kts in seven seconds. The loss of speed and the tremendous downdraft made a go-around impossible.

On August 7, 1975, Continental Flight 426 took off at 1610 from Stapleton International Airport at Denver. At approximately 100 feet above the runway, airspeed dropped from 158 kts to 116 in five seconds and the aircraft descended to the ground. Another victim of a severe downdraft cell.

In the foregoing two cases. small but extremely violent cells known as down bursts caused the accidents. This is a recently discovered phenomenon, which indicates that we still do not fully understand the thunderstorm mechanism.

So far we have discussed only the shear and associated turbulence resulting from the tremendous downrush of air and rain in thunderstorm cells. But there are other dangers which can be just as bad. Lightning is one of the most common things associated with thunderstorms. Lightning occurs within the cloud, from cloud-to-cloud, cloud-to-ground and can travel several miles. Aircraft apparently trigger lightning by building up a charge from friction with particles in the air. When an aircraft enters a cloud it can trigger a strike. Generally, strikes cause little damage, but occasionally they cause severe problems such as loss of a radome and, in a few cases, structural damage to components such as the vertical stabilizer.

There are very few documented cases in which lightning triggered an explosion in an aircraft but it has happened. The correct mixture of fuel vapor and air in a tank at the right temperature results in a very explosive mixture that lightning theoretically, at least, could detonate. Lightning seems to like a temperature of about +5°C to −5°C.



A model of a tornado cyclone, which was presented before the Subcommittee on Space Science and Applications, Washington, D.C.. November 6, 1973.

Hail is another feature the T-storm serves up. Usually hail is found in the center of the storm, but a good, strong updraft can lift it and throw it out the sides and top. Winds carry hail as much as 20 miles away, where an unsuspecting pilot, flying in crystal clear, calm air, can suddenly hear the pinging of hailstones on the skin of his aircraft. Hail is bad news. It damages composite materials such as radomes, peens leading edges and tears up antennas. It can also damage inlet guide vanes and other engine components. Hail accompanied by a large volume of water can cause compressor stall and even engine failure. Witnesses aboard a DC-9 that crashed near Atlanta in April said that prior to engine failure there was intense hail and a lightning strike on an engine nacelle.

Almost always present in the vicinity of T-storms is turbulence—from light to medium chop to extreme turbulence in the storm. It is a product of shear and is most severe in the heaviest moisture area. Radar is the best weapon available for avoiding severe thunderstorm turbulence, but there are limits. It can't "see" turbulence; rather it sees the moisture in the air. The ISO-ECHO feature better defines the area of high moisture. Recently, RCA announced a new multicolor radar. The area of heaviest rain—maximum turbulence—shows red. Around it—less moisture and less turbulence—the picture is yellow. Beyond that in the clear, the picture is green. But don't look for it in your aircraft anytime soon.

With airborne radar, you're in good shape. If you don't have it, your air traffic controller may help out. However, he may not be able to provide weather radar service at all times.

All thunderstorms are potentially dangerous and should be avoided. When penetration is unavoidable, the aircraft should be configured in accordance with the Dash One. A request for controller assistance should be made as early as possible.

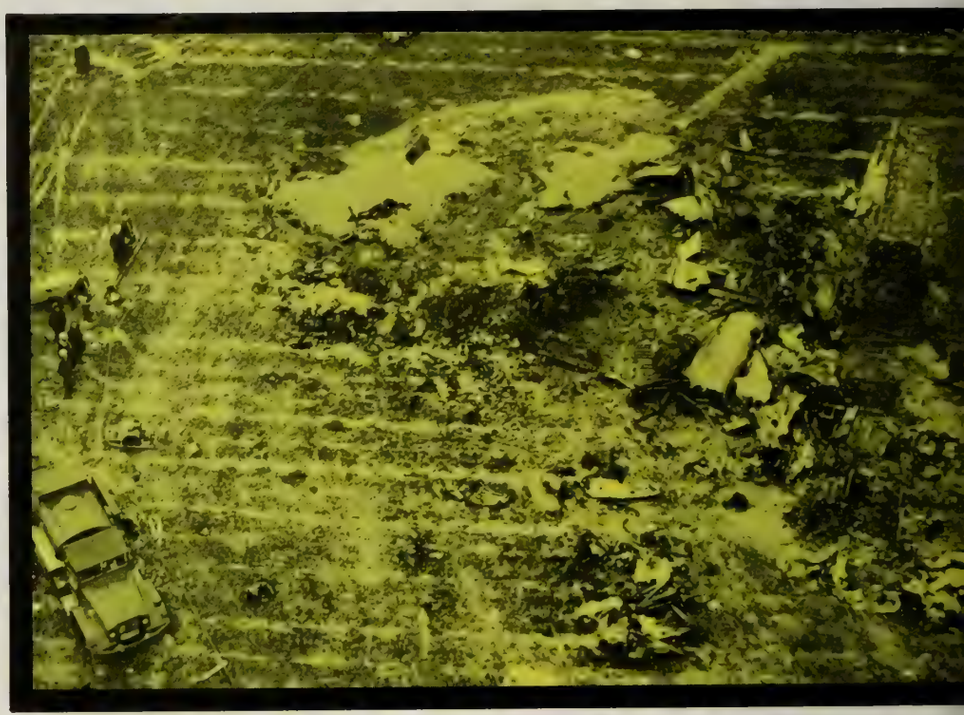
Pilot reports can be especially helpful, particularly in areas of high traffic density when weather is rapidly changing.

Areas of severe weather can often be avoided by careful planning. However, keep in mind that forecasters cannot predict with required accuracy thunderstorms that have not yet formed, time and place of extreme turbulence, when freezing rain will occur. ★

Addressing "Collision With The Ground" Accident

A MULTI-PRONGED ATTACK

MAJOR THOMAS R. ALLOCCA, Directorate of Aerospace Safety



The aircraft, the aircrew members and the operating environment are three aspects of the aircraft safety problem. We've come a very long way with the aircraft, although we've yet to produce an accident-proof airplane. The other two have far more unpredictable variables, especially the aircrew members. They, in general, pose the knottiest problems for those concerned with aircraft accident prevention. The aircrew successfully completes a mission on one day and then collides with the ground on the next. Why?

The accident narrative stated ". . . the aircraft was flown into a mountain and was totally destroyed . . . the crew members received fatal injuries . . ." The total cost of the mishap exceeded 13 million dollars.

Another narrative reads: ". . . the aircrew accepted a clearance and descended to an altitude lower than the minimum sector altitude in mountainous terrain. The aircraft struck a mountain, was totally destroyed, killing all aboard." The total cost of this mishap exceeded 7 million dollars.

A third accident occurred when "the pilot at the controls descended below minimum approach segment altitude." This mishap, involving seven fatalities, cost well in excess of 3 million dollars.

The accident board report on accidents of those types generally concludes with causal factors such as "descended below minimums" or "descended below safe terrain clearance altitude." While such statements are totally true, they don't address the nagging question: Why? Why does a competent, trained pilot descend below a safe terrain clearance altitude until he hits the ground? Why does an experienced aircrew, which have been briefed about the hazards of flight in mountainous terrain, descend below minimum terrain clearance altitudes? In many, perhaps most, cases the accident investigators simply "don't know." Perhaps the most significant aspect of such findings—from the accident prevention viewpoint—is that they leave little, if any, foundation upon which to build a program of remedial action. Consequently, various schools of advocacy arise, each seeking to correct the problem.

One approach attempts to solve the "collision-with-ground" problem by instituting a piece of "warning equipment," whose function would be to alert the crew of im-



pending disaster. Similar devices have traditionally been incorporated—with success—into the fleet as a result of an alarming number of mishaps. For example, the jet engine overheat warning systems, common to Air Force aircraft, were incorporated to alert the crew of potential engine problems. A ground collision warning device, the equipment enthusiasts assert, would function much the same way, alerting the crew of a flight condition which must be corrected to prevent ground impact. They also cite, as supporting rationale, that the Air Force has opted to outfit a small portion of its fleet with a ground proximity warning system. We should be cautious, however, of jumping on the warning systems bandwagon since they may not prove to be a panacea.

There are several ways in which a crew may become aware of a potentially dangerous situation. Our experiences with a variety of audio and visual warning devices, and various combinations, indicate none have met our expectations. Mishaps still occur, many even though the devices functioned properly. Why is it then, that, in spite of such systems, accidents still occur due to incorrect crew actions following a warning indication?

Some safety experts believe that present-day warning systems are unsatisfactory and that the addition of still more colors, bells or buzzers may not lead to significant safety improvements. These specialists do not discount the utility of warning systems; they believe, rather, that if such devices are to be truly effective, what may be needed is a basic change in the philosophy on which such a system is based. They maintain that these systems will always contain a basic shortcoming—that of not prioritizing the relative urgency of the warning—and that until this basic deficiency is rectified, alerting systems will not be totally effective.

A second approach to addressing the "collision with the ground" mishap problem would have Air Force make a broad-scale review of training strategies and tactics. This approach assumes that the problem can best be addressed by evaluating the training concepts and procedures used to prepare aircrews for low level* flight operations.

However, devising a training strategy which will minimize the kinds of mishaps described above is a difficult undertaking. Learning and human behavior theories have undergone great changes in recent years and the resulting kaleidoscopic effect has tended to fragment, rather than simplify, training strategies. Nevertheless, the training advocates insist that we need to continually review such things as curricula development, student/instructor selection criteria and training aid selection/use to ensure that we are using sound rationale to develop and implement training strategy.

In the final analysis, we really do not know "why" these mishaps occur and can't readily choose one approach over another. Or at least not with any real conviction. Our investigations in the past have been material failure oriented. We now need to really address the nagging question of "why" by improving the quality of our mishap investigation. Accident investigators have spent many hours trying to puzzle out the "why" of these kinds of accidents. In some cases they have been able to suggest, if not absolutely prove, one or more reasons for the departure from a normal flight path. When these reasons are suggested, however, they more often appear to be strokes of brilliant intuition on the part of a single investigator rather than the result of an established, proven, deductive, investigatory process.

Proponents of the need to "improve the quality of the investigation" argue—with considerable vehemence—that we have become expert at reconstructing the wreckage of an aircraft mishap to determine

*Low-level operations include "terrain following/low level flight," penetrations, approaches and landings.

what "mechanically" caused the accident. What we are not able to do, they contend, is to dig into the human factor elements which must be the underlying cause of an accident when mechanical, support and procedural cause factors have been eliminated. Advocates of this approach suggest that we must first master this ability before we can effectively answer the "why?".

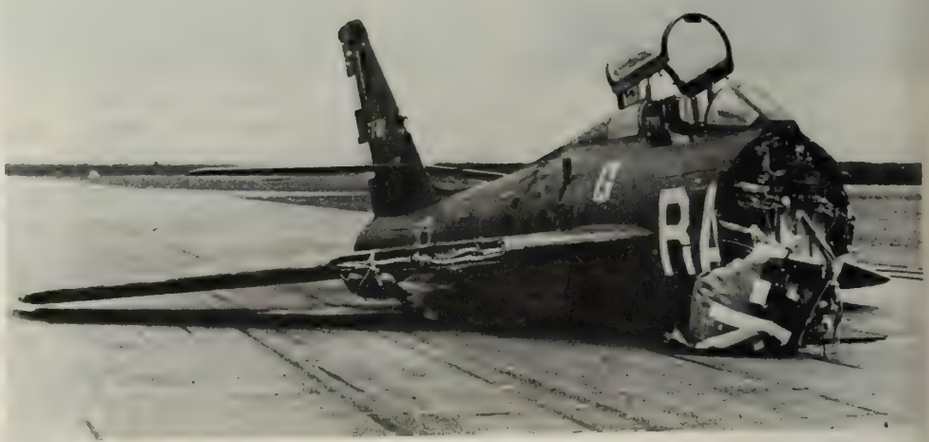
However, this course is also not easily achieved. Delving into an accident to uncover the deep psychological, or perhaps, psycho-physiological, reasons for human deviation is difficult at best, impossible at worst. It would be foolhardy to suggest that a USAF mishap investigation board would ordinarily possess the necessary expertise to address such issues. Moreover, the human factors aviation communities have not provided the accident investigator with the basic research from which he can construct an effective, deductive "checklist."

How should USAF prevent recurring "collision-with-ground" accidents? Equipment modifications? Enhanced training? The proponents of each of these approaches do not deny the validity of the others, but believe, rather, that the area of their particular interest offers especially significant opportunities for enhanced safety. I submit, however, that while each approach contains an essential kernel of effectiveness, the answer may lie in a combined effort.

First, we must improve the quality of our investigations of people-caused mishaps. Such improvement will likely lead to valid, effective recommendations. Many, if not most of these recommendations, will involve the areas of equipment improvement, procedural changes, training improvement, and other relevant activities. We must then ensure that we implement, as expeditiously as possible, the agreed-to recommendations.

I believe that the synergism resulting from a coordinated attack, equipment modifications, better training and improved mishap investigations, will go a long way to not only answering the "why?" but —more importantly—to ensuring that the question is not asked time and time again. ★

The Pilot Walked Away



A student pilot was following his instructor in close trail formation through combat maneuvers in F-84F's. The instructor made a sharp turn and the student was unable to follow. He lost his leader, applied power, climbed and collided with Lead and went into a steep spiral or spin. The student was unable to recover, so at 5,000 feet, 500 knots, he ejected successfully and without injury. The aircraft exploded on ground impact and was destroyed.

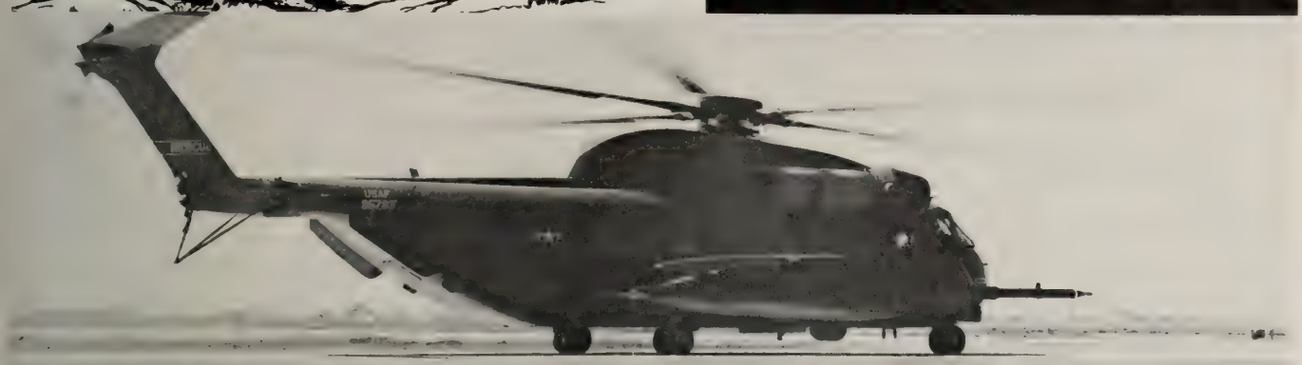
The entire nose section of the instructor's aircraft (555) was torn off as a result of the collision; but the pilot was unaware of it. He felt some vibration at 89%, so he reduced throttle to 35% and returned to base. Unable to operate the landing gear with either the normal or emergency system, the pilot elected to land wheels up on the runway. Damage from the collision plus the skid on the runway was such that the aircraft was considered a wreck. The pilot was unhurt.

Photo and narrative courtesy of the Fairchild Republic Co.

This event occurred in the 1950's and involved a Belgian aircraft. ★



THE SDU-5 NRS, ELF AND YOU



CAPTAIN RONALD E. VIVION and TSgt CHUCK MORROW
Operations and Requirements Branch, 3636th Combat Crew Training Wing, Fairchild AFB, WA

ITEM—SDU-5/E DISTRESS MARKER LIGHT

Flashing strobe beacon carried by aircrews for use in facilitating rescue or alerting forces to position on ground. Includes a blue flash guard to prevent mistaking flash for ground fire and an infrared (IR) hood for use with selected recovery systems (see Fig. 1).

ITEM—NRS—NIGHT RECOVERY SYSTEM

Consists of on-board equipment carried on selected HH-53 "Super Jolly Green Giant" rescue helicopters. Combines visual and electronic emissions from ground personnel to facilitate rescue of downed crew members at night.

ITEM—ELF—ELECTRONIC LOCATION FINDER

Consists of on-board equipment carried on selected HH-53s. Utilizes electronic emissions from crew member on ground to precisely locate survivor position and aid in approach and recovery for pickup.

ITEM—YOU.

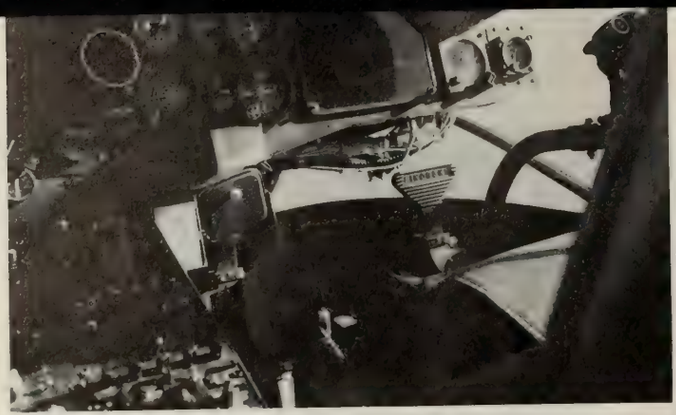
The survivor on the ground, or water, having specific responsibilities to help the rescue forces in recovery, under any conditions.



SDU-5 strobe. Light must be visible and stationary for successful rescue.

The problems associated with the rescue of a downed crew member have multiplied greatly with the growth of rescue and survival possibilities. We may not have air superiority in the next "go-around"; nor may we be able to soften up an area sufficiently to insert a gaggle of rotorwings. On the plus side though, there are some newer pieces of gear in the inventory which will allow a helicopter to insert into an area, grab you, and run.

Let's assume that you have been shot down in a medium-threat area and survived to the point of making contact with the SAR Forces. With the state of the art of point defense increasing in quantum leaps, that medium-threat area could quickly turn into an extreme threat if a full-blown SAR is initiated. So, covert SAR may be the only answer.



The right side of an HH-53 cockpit showing the NRS equipment installation.

Covert SAR implies that "don't nobody know about it, 'cept them that's doing it?", and that's the meat of this discussion—get a rescue craft into the area, locate the survivor, and rescue him/her without the enemy being aware of the activity. One means of doing this is to utilize natural masks: namely, darkness, weather, terrain, and small forces (hard to detect). That is what the ELF and NRS systems are all about. They are designed to allow a helicopter to E&E into a defended area in normally adverse conditions. I'll briefly discuss each of these systems and your responsibilities.

The ELF system depends on radio transmissions from the survivor on either 243.0 or 282.8 and only these frequencies. These signals are converted into guidance directions to the crew. The approach is flown manually, and the hover can be done automatically or with good old hands-on talent. Whichever method is used, the survivor must follow directions explicitly. If a 15-second hold-down is requested, that's exactly what is needed. The pilot may request you to turn on your beacon, leave it on, make a short transmission on your survival radio, or a combination of these tasks. Do what he says . . . but a little human cross-check will help matters considerably. If you hear or see the aircraft, say so, and keep the pilot informed of his progress. This is where sound vectors and your compass can be extremely valuable. Line-of-sight transmissions will be critical when using this equipment, so rescue will be aided if your hiding spot uses available terrain to enhance your transmissions.

As the name implies, NRS is used to make night pickups. NRS-equipped aircraft use visual navaids, or sensors, and possibly the ELF system, to do this. As a survivor, you must know that it is vitally important to follow directions. You must have the SDU-5 strobe light ready with its IR hood attached. If the hood is not in place, the high-intensity strobe light will zap the sensors when you turn it on. Also, the strobe must be stationary since it is used as a hover reference. If you move it around while the chopper is in a hover, the aircraft will make a corresponding shift. Place your strobe in an open area. Keeping it with you in a bush will confuse the issue, since the leaves diffuse the light. We can think of few things worse than an HH-53 trying to use a leaf for a hover reference. Remember that when you are on the hoist, the chopper is still using that hover reference; so if you don't want to go swinging through that bush or tree several times on your way up, pick a nice, open clearing and set the strobe there.

There has been a great deal of discussion in the past about the noise that the SDU-5 makes when activated. The clicking sound as the strobe discharges and the small whine associated with the charge build-up are noticeable when all is quiet. With a "53" clattering around in your neighborhood, you shouldn't have much fear of the sound giving away your location. If it bothers you greatly, you can muffle the sound by cupping your hands around the sides of the beacon. Unmuffled, the sound of the strobe still can't be heard even at moderate distances.

All of this activity in your area will certainly draw some attention from opposing forces. The primary factors to keep in mind are to be careful, use your head, and have a little faith in your own abilities. Don't hesitate to take charge of your SAR if you see the situation requires it; but you still must follow directions explicitly and avoid those small errors that can be costly.

To improve night recovery capabilities, the new PAVE LOW III system is coming into the inventory. As test results become available, we'll update you on both its characteristics and your responsibilities concerning its use.

Now . . . here's a short quiz. Without conferring with anyone, answer these questions:

1. Do I have a strobe light (SDU-5) in my survival gear?

2. Where is it located?

3. Does it come equipped with both hoods (blue flash-suppressor and IR)?

4. Can I operate it in the dark?

If your answer was "no" or "I don't know" to one or more of these questions, we highly recommend that you get with your Life Support Survival training folks and find out all of the answers.

Comments and questions concerning the information contained in this article may be forwarded to 3636th Combat Crew Training Wing/DOTO, Fairchild AFB WA 99011, AUTOVON 352-5470. ★

The excellent article which first appeared in the Digest of U.S. Naval Aviation Weapons Systems, *Aeronautics Edition, April 1969, on the generation of static electricity in aircraft fuel systems was presented at the Lightning and Static Electricity Conference in December 1972, sponsored by the Air Force Avionics Laboratory, Air Force Systems Command. Recently, the Air Force has experienced fires in the F-105, A-10 and UH-1 fuel tanks which occurred during aircraft fueling operations. Therefore, this article is not only timely but also provides the technical information as to why this hazardous condition exists. Action has been initiated by AFSC to provide the solution to reduce or eliminate the electrostatic hazard during aircraft fueling.*

ELECTROSTATICS IN JET FUELS

DR. JOSEPH T. LEONARD

A hydrocarbon liquid such as jet fuel develops an electrostatic charge as it flows over another surface. Although the exact nature of the mechanism involved is not completely understood, the charge is generally thought to be caused by ionic impurities in the liquid in parts-per-million or parts-per-billion quantities. These impurities, though inactive when the fuel is at rest, can contribute sufficient charge to the fuel in motion to produce fires or explosions at the point of discharge. Thus, electrostatic activity can be hazardous in jet fueling operations.

CHARGE MECHANISM

When the fuel is at rest, the impurities are absorbed at the interface between the fuel and the walls of the container, with one part of the ionic material showing a strong attachment for either the fuel or the metal surface. The negative portion of the molecule, more strongly attached to the wall, and the positive part, remaining in the liquid, form a sort of double layer along the wall. When the liquid is at rest, the numbers of both positive and negative charges are equal and hence there is no net charge on the fuel.

However, when this same fuel begins to flow, the charges separate, and positive ions are swept along with the fuel while the negative ions migrate to the wall of the pipe. In this manner, the fuel acquires a net positive charge as it moves through the system.

When the charged fuel is loaded into a tank, either of two possibilities will occur: (1) the charge will relax naturally and harmlessly to the walls of the container or, (2) if the conductivity of the fuel is sufficiently low, the charge may accumulate and give rise to high potentials on the fuel surface. If conditions are right for local potentials to exceed the breakdown value of the vapor space, electrical discharges will take place. Whether or not the vapor ignites then depends on the composition of the vapor and the nature of the discharge.

Charge Relaxation

Aircraft fuels in general, and jet fuels in particular, are susceptible to electrostatic charge generation primarily because of their low conductivity. The rate at which the charge on a fuel relaxes depends on its conductivity, as shown in the equation:

$$Q = Q_{\sigma\varepsilon} - tK/\varepsilon\varepsilon_\sigma$$

where

Q_σ = initial charge
Q = charge at time
ε = dielectric of free space
ε_σ = permittivity of free space
K = conductivity of the fuel

Since charge decay is an exponential process, the charge never goes completely to zero. Therefore, in discussing charge decay, it is more convenient to speak

ELECTROSTATICS IN JET FUELS

continued

of the relaxation time constant, T, which is the time required for the charge to decrease to 37% of its original value. For, when $Q/Q\sigma = 0.37$,

$$tK/\varepsilon\varepsilon\sigma = 1$$

and

$$r = \varepsilon\varepsilon\sigma/K.$$

Thus the relaxation time constant is similar in concept to the RC time of an electrical circuit. The relaxation time constants for fuels of various conductivities are shown in Table I.

If the conductivity of the fuel is less than 10^{-14} mho/cm, the charge may relax faster than predicted by this equation. However, most jet fuels have conductivities in the range of 10^{-14} to 10^{-13} mho/cm (see Figure 3). Since the relaxation time constants for fuels in this range may be as long as 18 seconds, it is possible for such fuels to build up dangerous potentials during fuel-handling operations.

Charge Increase

The generation of charge on fuels flowing through pipes sharply increases with the introduction of a filter system into the line, as shown in Figure 1. A typical aircraft refueling operation is depicted at the top of the figure. Fuel from a hydrant line passes through a dispenser cart containing a filter/separator unit and then on to the aircraft wing tank. The graph at the bottom of the figure plots the level of charge on the fuel as it passes through the various pieces of equipment shown directly above. When the fuel passes through the filter/separator unit, there is a tremendous increase in the level of charge on the fuel.

Thus, fuel enters the aircraft in a much more (10 to 15 times more) highly charged condition than if it had not been filtered. The reason for this increase is that the filter provides a large amount of surface area on which the charge separation process can take place within a comparatively short time. And, since there is little opportunity for charge relaxation to occur, the fuel emerges from the filter/separator and enters the aircraft in a more highly charged condition. How hazardous is this charge to the fueling operation?

TABLE I.
Relaxation Time Constants For Fuels.

Conductivity (mho*/cm)	Relaxation Time Constant (Sec.)
10^{-15}	180
10^{-14}	18
10^{-13}	1.8
10^{-12}	0.18
10^{-11}	0.018

*mho - Conductance of a body having a resistance of one ohm per centimeter.

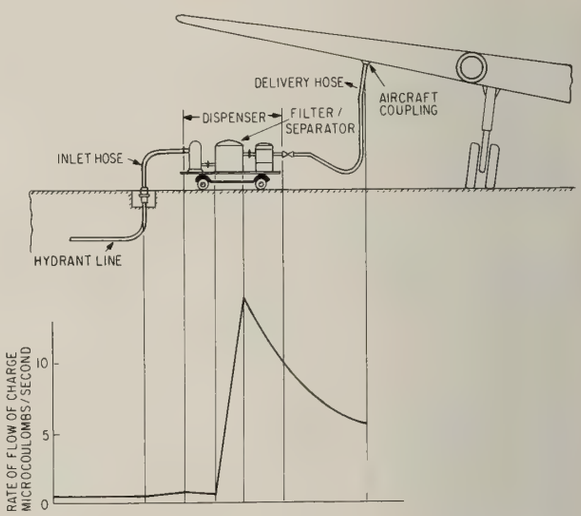


Figure 1. Effect of Filtration on Fuel Charging in an Aircraft Refueling System. Reproduced from Winter. E.F., Roy.Aero.Soc.66 429(1962)

IGNITION HAZARD

In comparison with the thousands of safe fuel-handling operations conducted daily all over the world, there have been very few fires or explosions resulting from static electricity generated by the fuel. Yet, during one winter in Canada, the RCAF experienced several electrostatically ignited fires while refueling jet aircraft with JP-4 fuel. This means that, given the proper set of circumstances, electrostatic charging of fuels can con-

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stitute a real hazard. The conditions necessary to produce this hazard are: the presence of a flammable fuel/air mixture in the vapor space of the tank and a discharge of sufficient energy and duration.

Flammability

As suggested in Figure 2, not all fuel/air mixtures can be ignited. Instead there is a definite concentration range over which mixtures of each hydrocarbon in air will burn. This is called the flammable range. For a material such as n-octane, a hydrocarbon found in jet fuels, the flammable range extends from 0.92 to 6.5 percent of n-octane in air. If the upper limit of this range is exceeded, the mixture becomes too rich in hydrocarbon to be ignited. Likewise, if the fuel vapor concentration falls below the lower limit, insufficient hydrocarbon is present in the vapor space to sustain combustion.

Using temperature limits rather than concentrations, Figure 3 presents the flammable range of several common fuels. The areas described by the double-headed arrows represent the flammable ranges for the individual fuels. Avgas, for example, is seen to be in the flammable range from −40 to 20°F. Above 20°F, equilibrium mixtures of Avgas in air are too vapor-rich to be ignited. For JP-4, the flammable range extends from −35 to aproximately 75°F. Above 75°F, JP-4 passes into the vapor-rich region. For kerosene, the lower flammability limit corresponds to about 110°F, and for JP-5, it is 140°F.

The temperature-flammability limit concept applies only to situations in which the liquid fuel is in equilibrium with its vapor. Consequently these limits should be used only to estimate the composition of a fuel/air mixture in a quiescent tank. At best, they can serve only as a rough guideline in describing the situation that exists inside an aircraft wing tank during refueling. In practice, these conditions may vary widely from ideality.

With kerosene, for example, "flammable" fuel/air mixtures can be produced, during refueling, at temperatures far below the lower flammability limit for that fuel. In this case, however, the flammable mixtures consist of foams or mists generated by the splashing action of the fuel rather than equilibrium fuel-vapor/air mixtures. Such foams and mists can be ignited at temperatures below the lower flammability limit of the particular fuel in question if sufficient energy is supplied. There is one case on record in which an electrostatic ignition occurred while a commercial aircraft was being refueled with an aviation kerosene that had a flash point of 95°F. At the time of the ignition, the fuel temperature was 55° (40° below its flash point). Thus, the flammability of mixtures depends not only on fuel temperatures but also on the circumstances prevailing inside the tank during fueling.

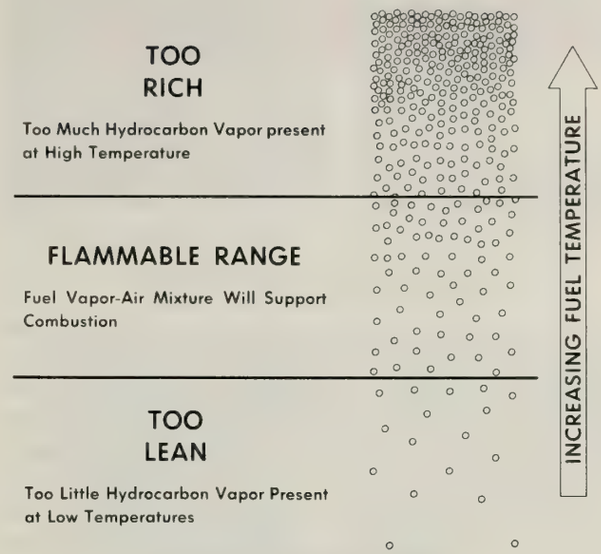


Figure 2. Flammability Concept.

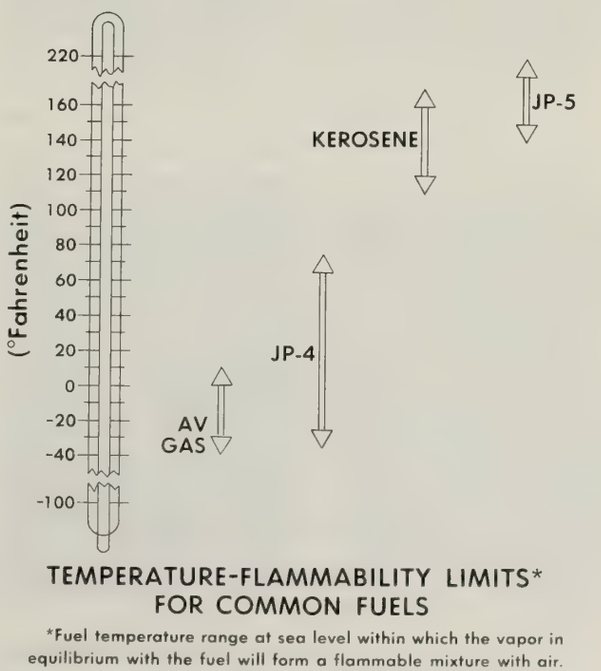


Figure 3. Temperature-Flammability Limits for Common Fuels.

ELECTROSTATICS IN JET FUELS

continued

Discharge Energy and Duration

The amount of energy required for a spark to ignite a fuel/air mixture under ideal conditions is very small —a mere 0.2 millijoule. Ideal conditions are:

(a) An optimum fuel/air mixture and

(b) A spark discharge taking place between two metal electrodes at a gap of 0.2 inch. Sparks having energies considerably in excess of 0.2 millijoule can occur in the vapor space of fuel tanks during the course of aircraft refueling operations. Yet, despite the frequency of these discharges and the fact that, at least part of the time, the vapor/air mixture above the fuel is in the flammable zone, there have been relatively few explosions during refueling that can be attributed to electrostatic ignitions.

The big question is: Why? What is so distinctive about discharges from a charged fuel surface that they seldom produce explosions? To find answers to these questions, scientists at the Naval Research Laboratory have developed an apparatus (Figure 4) capable of producing sufficient charge on a fuel surface to break down spark gaps of up to 15 centimeters. Fuel (in this case JP-5) was circulated through a filter and into an insulated polyethylene tank, where discharges from the fuel surface to a grounded electrode could take place. The discharges were photographed through a window at the side of the tank and the quantity of charge transferred was measured with an appropriate circuit.

Because the nature of the discharge (corona or spark) depends on the configuration of the electrodes, a wide variety of electrodes (including a needle point, spheres of diameters varying from 9/32 inch to 2½ inches, and a metal plate) were used in this study. Discharges between a charged fuel surface and these grounded probes were compared with similar discharges between a metal plate used to simulate the fuel surface and the same grounded probes. The object of the comparisons was to determine what distinctive properties of discharges from fuel surfaces make them less incendiary than discharges from an all-metal electrode system.

TYPE OF DISCHARGE

Table II summarizes these discharge measurements. The first column lists the various grounded electrodes; the remaining columns indicate the types of discharge obtained from the fuel surface and the metal-plate electrodes. When the needle and 60-degree point electrodes were used, the usual type of discharge from the fuel surface and the metal plate was a corona. At very small gaps (2.5 cm or less), however, the 60-degree point electrode produced spark discharges from both fuel surfaces and metal plates. Since spark discharges

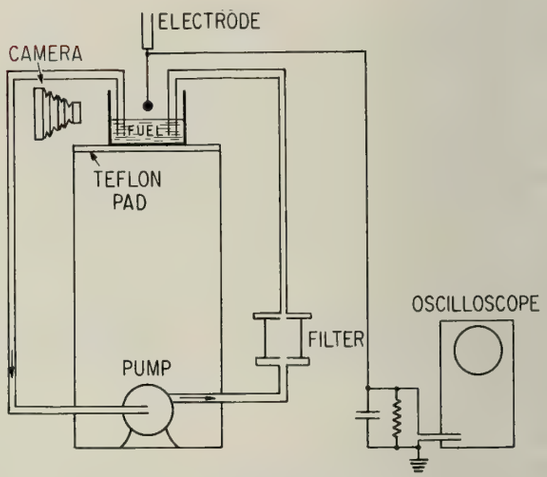


Figure 4. Apparatus Used to Study Discharges from Fuel Surfaces.

are more energetic and more likely to cause ignitions than corona discharges, they are considered to be more hazardous. Consequently, pointed electrodes cannot be used within aircraft fuel tanks to bleed off charges harmlessly from fuel surfaces, as is occasionally suggested.

The usual type of discharge from the metal-plate spherical-electrode system was a spark. The energy of these discharges increased with the larger diameter of the sphere and the gap width. Another type of discharge, a prebreakdown streamer, was also found with the quarter-inch and half-inch spherical electrodes at larger gaps. In an all-metal electrode system, these streamers play an important part in the development of filamentary sparks. With such a system, streamers start at the anode as separate filaments or as a trunk and combine to form a treelike configuration with multiple branches. The majority of these streamers stop halfway across the gap and are referred to as secondary streamers. However, some streamers manage to traverse the entire gap and, in so doing, pave the way for the main stroke (spark), which follows the most vigorous primary branch. In this study, most of the prebreakdown streamers obtained with the quarter-inch and half-inch sphere-to-plate electrode systems were followed by spark discharges. It was also shown that the streamers could be produced without spark dis-

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charges merely by placing the proper resistor in series with the gap.

When the half-inch and one-inch spherical electrodes were used opposite the charged fuel surface, prebreakdown streamers were the only type of discharge obtained over the entire gap range studies (2.5 to 15.0 cm). Unlike the streamer discharges from the metal plate, the prebreakdown streamers from the fuel surface were never followed by spark discharges. Other differences in the behavior of the two electrode systems (fuel surface and metal plate) are apparent in the various types of discharges illustrated in Figures 5 through 8.

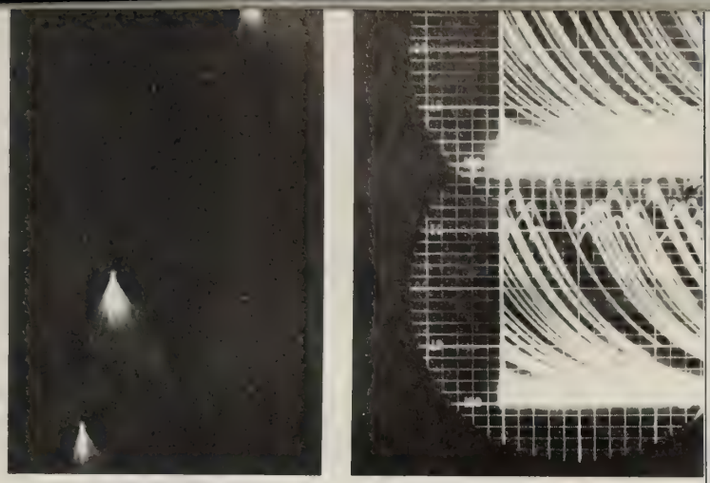
Figure 5 shows the type of discharges obtained with the 60-degree point opposite the metal-plate electrode. In the photograph, the discharges exhibit the paintbrush-like form which is typical of corona discharges at electrodes with high positive potential. The accompanying oscillographs show that the corona discharges were composed of many individual low-level discharges per unit length of time. From time-exposure oscillographs, it was determined that the frequency of these discharges increased from 100 to 900 discharges per second over the gap range of 1 to 8 centimeters. The energy of the individual discharges increased from four to 11 microjoules over the same gap range.

The 60-degree point electrode opposite the fuel surface gave the typical paintbrush-like structure of the corona discharges (Figure 6). The energy of the individual discharges in this photograph are of the same order as those from the metal plate. However, the frequency of the discharges (approximately 80 discharges per second) was not only less than that for the all-metal electrode system, but it also remained constant over the gap range investigated.

Only spark discharges were found in the one-inch sphere-to-metal plate electrode system (Figure 7). In this photograph, the spark discharge appears as a continuously luminous channel spanning the gap between the sphere and the plate. The oscillograph shows the spark as a discrete discharge, quite different from the multiple-discharge patterns found for the corona discharges with the smaller electrodes.

The one-inch spherical electrode opposite the fuel surface produced prebreakdown streamer discharges (Figure 8) characterized by a brightly luminous channel extending approximately one to two centimeters from the spherical electrode. Beyond this point, the structure of the discharge became so highly branched that it was difficult to detect photographically, even with long exposures such as were necessary to produce this illustration. The streamers appeared on the oscillograph as single discrete discharges.

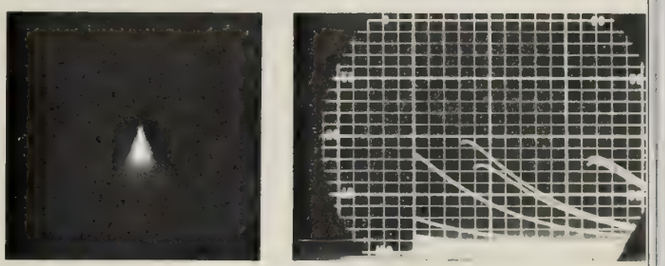
The frequency of formation of prebreakdown streamers depends on the charging tendency of the fuel. In



DISCHARGES
1-SECOND EXPOSURE

OSCILLOGRAPH
1-SECOND EXPOSURE

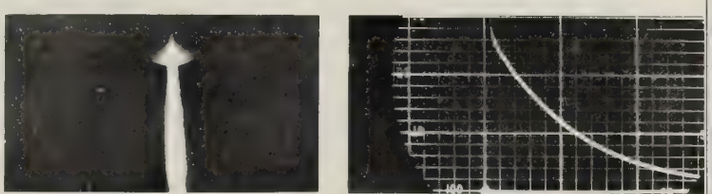
Figure 5. Sixty-Degree Point Versus Metal Plate Discharge.



DISCHARGES
60-SECOND EXPOSURE

OSCILLOGRAPH
1/10-SECOND EXPOSURE

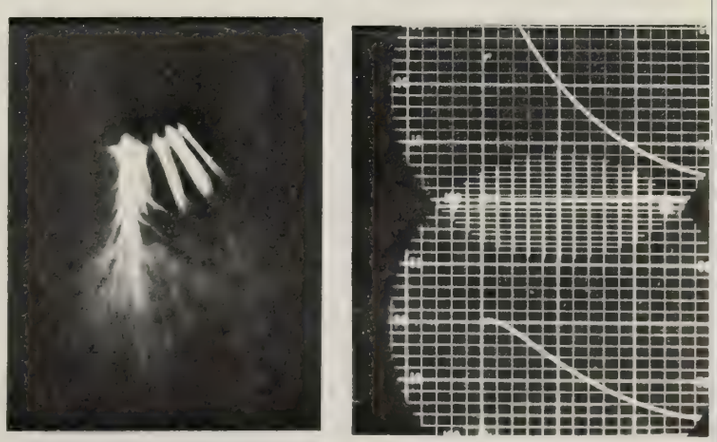
Figure 6. Sixty-Degree Point Versus Fuel Surface Discharge.



SINGLE DISCHARGE

OSCILLOGRAPH

Figure 7. One-inch Sphere Versus Metal Plate Discharge.



20 SUCCESSIVE DISCHARGES
GAP 10cm

OSCILLOGRAPH

Figure 8. One-Inch Sphere Versus Fuel Surface Discharge.

TABLE II.
Comparison Of Discharges From Fuel Surface To Grounded Probes Of Various Configurations With Discharges From Metal Plate.

	DISCHARGES FROM FUEL SURFACE		DISCHARGES FROM PLATE	
Grounded Electrode	Gap (Cm.)	Type of Discharge	Gap (Cm.)	Type of Discharge
NEEDLE	1.0 - 5.0	CORONA	1.0 - 3.0	CORONA
60° POINT	2.5 2.5 - 15.0	SPARK CORONA	0.25 1.0 - 8.0	SPARK CORONA
1/4" SPHERE	2.5 - 15.0	CORONA	<0.9 >0.9	SPARK PREBREAKDOWN STREAMERS
1/2" SPHERE	2.5 - 12.5	PREBREAKDOWN STREAMERS	<1.0 >1.0	SPARK CORONA AND PREBREAKDOWN STREAMERS
1" SPHERE	2.5 - 15.0	PREBREAKDOWN STREAMERS	0 - 1.6	SPARK

these experiments, conditions were adjusted to produce only two or three streamers per minute so that individual discharges could be measured. However, as many as 100 streamers per minute could be produced through the proper control of the conductivity of the fuel, the effectiveness of the filter, and the pumping rate of the discharge apparatus.

The prebreakdown streamers from the fuel surface resembled spark discharges in that they were audible as a single report, could be seen by the naked eye in a darkened room, and appeared on the oscilloscope as a single discharge. However, they were much less energetic than spark discharges, as indicated in Figure 9.

In this figure, the energies of the prebreakdown streamer discharges from the fuel surface are compared with those of the spark discharges from the metal plate (both opposite the one-inch spherical electrode). Although the energies increased with expanding gap widths for both systems, the energy of a spark discharge was much greater than that of a prebreakdown streamer for comparable gap widths. Extrapolation of both curves of the graph to a 2.0-centimeter gap width gives a ratio of approximately 37 to one.

Not only were the prebreakdown streamers less energetic than spark discharges, but also they released over a much longer period of time. In highspeed oscilloscope studies, the duration of the prebreakdown streamer discharge was up to seven times longer than that of a spark discharge at a comparable gap width. The increase is ascribed to the properties of the fuel itself that cause it to behave as a resistor in series with the gap.

The ability of prebreakdown streamer discharges from a fuel surface to produce an ignition was tested by substituting JP-4 fuel for the JP-5 fuel normally used in the fuel-charging apparatus. At temperatures ranging from 45 to 55°F, which are well within the flammability limits for JP-4 (Figure 3), repeated prebreakdown streamer discharges from the fuel surface failed to produce ignition, although spark discharges under the same conditions did ignite the fuel vapor.

CONTROL OF THE ELECTROSTATIC HAZARD

Outside the United States, and particularly in Canada and Great Britain, the use of a static disipator additive is generally accepted as the most practical solution to the problem of electrostatics in fuels. The additive, which is now included in the Canadian specifications

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for jet fuel, is expected to be adopted by the British soon. In addition, over 80 airlines have agreed to pick up fuel containing the additive which is currently available throughout Canada and at a large number of international airports scattered throughout the world.

In the United States, a great deal of reliance has been placed on the concept of providing a 30-second relaxation time during fuel-handling operations. (In this case, relaxation time refers to the time required for a drop of fuel to travel from the filter to the receiving tank.) Tests have shown that, regardless of the conductivity of the fuel, most of the original charge on a fuel is dissipated after 30 seconds of relaxation. However, at a number of aircraft refueling installations in this country, considerably less than 30 seconds of relaxation time is allowed. Under these conditions, the hazards of electrostatic discharges may mount, particularly when faster flow rates are employed. Although these systems may have been afforded some measure of

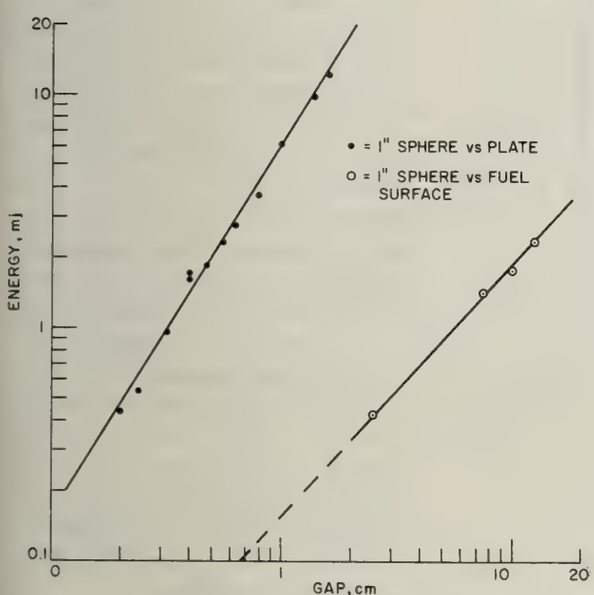


Figure 9. Energies of Discharges from Metal Plate to One-Inch Sphere Versus Discharges from Fuel Surface.

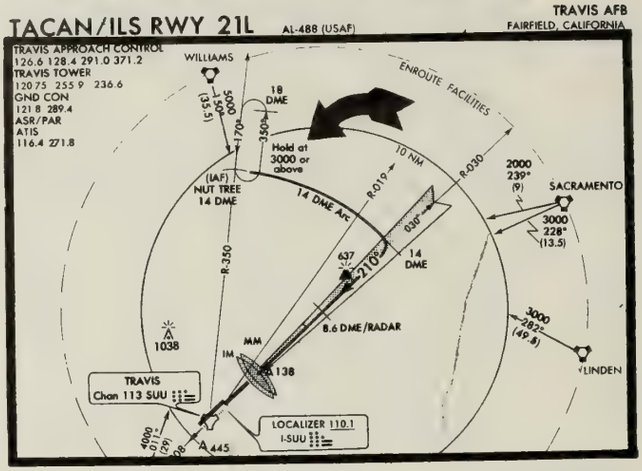
protection from electrostatic ignitions in the past by the production of prebreakdown streamers rather than spark discharges from fuel surfaces, this mechanism may not continue to provide protection under the anticipated high-speed refueling conditions. For example, it is known that the frequency of formation of streamer discharges increases sharply with flow rate. Consequently, at high flow rates, a fuel with a high charging tendency would be expected to produce many prebreakdown streamers in rapid succession. The incendiary nature of such rapidly occurring streamers cannot be predicted from our present knowledge about individual prebreakdown streamer discharges, nor can one say if, or under what conditions, these rapid streamers could lead to spark discharges. Without such information, we must regard the introduction of high-speed refueling in systems where considerably less than 30 seconds' relaxation time is provided as increasing the possibility of electrostatic ignition.

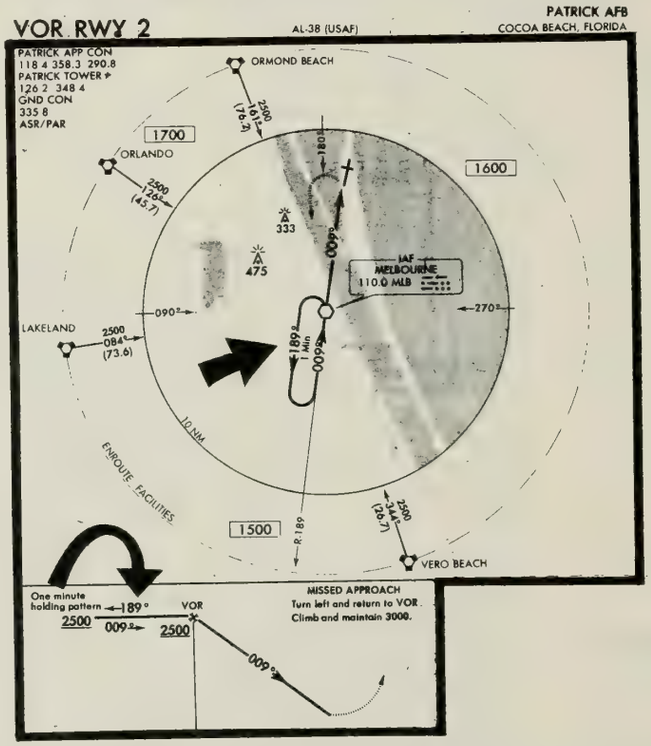
A device recently became available for reducing the level of charge on flowing petroleum products. Called the "Static Charge Reducer," it consists of a length of pipe containing an insulating liner through which a series of pointed electrodes protrude into the liquid flow. The highly charged fuel enters the reducer and produces an intense electrical field at the pointed electrodes, which then neutralize the fuel by the "lightning rod principle." The device is intended primarily for installation at loading racks and terminals. Its effectiveness for aircraft refueling has not yet been demonstrated.

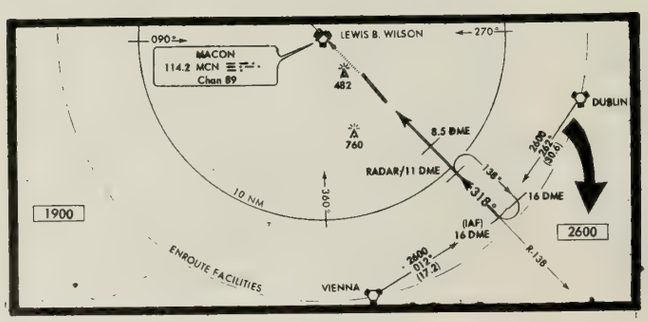
CONCLUSION

The amount of charge on a fuel when it arrives in a tank depends on such factors as the diameter and length of the piping, the flow velocity and conductivity of the fuel, and the presence of auxiliary equipment such as relaxation tanks and filtration units. When as a result of optimum conditions of pumping and filtration, a fuel reaches the receiving tank in a very highly charged condition, one would expect true spark discharges to take place from the fuel surface. On the other hand, the discharges described in this study, being low-intensity streamers, are the type that would be expected from a somewhat less highly charged fuel. A 1965 survey of aircraft-fueling operations throughout the world indicated that, while the charge density on fuels entering aircraft fuel tanks varies over a wide range, in most cases it is comparatively low. Naval Research Laboratory studies showed that when the charge on the fuel surface was low, prebreakdown streamers were the common form of discharge if the grounded electrode was not pointed. Thus prebreakdown streamers might also be a common form of discharge inside aircraft fuel tanks, at least when the ground electrode, i.e., the structural member of the tank that serves as ground for a given discharge, is not a sharp point. If so, the lack of fires and explosions during aircraft-fueling operations might be explained in part by the fact that frequently the charge on the fuel surface is dissipated in the form of the less incendiary prebreakdown streamer rather than the spark discharge. ★

THE IFC APPROACH







POINTS TO PONDER

The USAFIFC has recently received several inquiries concerning holding patterns, descent within holding patterns when cleared for the approach, minimum reception altitudes and minimum crossing altitudes. The following questions and answers may clarify any confusion concerning these subjects.

HOLDING

Q. How can I determine the minimum holding altitude of an arrival holding pattern depicted on an instrument approach procedure?

A. Currently, the only means of depicting minimum holding altitude is a statement in the planview next to the holding pattern, as in Figure 1 or the depiction of a holding pattern in lieu of procedure turn, as shown in Figure 2.

Q. If I am established in the holding pattern shown in Figure 1 or 2 and I receive an approach clearance, when may I descend?

A. You may descend to the published minimum holding altitude immediately upon receiving the approach clearance in both cases. (Note: This would apply only to procedures which depict a minimum holding altitude as described in the answer to question no. 1.)

Q. What procedure should be used in a Lost Comm situation when no minimum holding altitude is published, as in Figure 3, and you have arrived at the IAF prior to your EAC/ETA?

A. Hold in the published arrival holding pattern at your arrival altitude until the EAC/ETA. If you must descend to a lower altitude in order to safely fly the approach, descent should be accomplished within the published holding pat-

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tern. Since no minimum holding altitude is published, you may descend no lower than the published minimum or emergency safe altitude (whichever is applicable) and commence the approach from this altitude.

MINIMUM RECEPTION ALTITUDE

Q. What is Minimum Reception Altitude (MRA)?

A. MRA is the lowest altitude which assures reception of adequate navigational aid signals to determine a specific fix/intersection.

Q. In what instances may a pilot expect to find an MRA published on an enroute IFR chart?

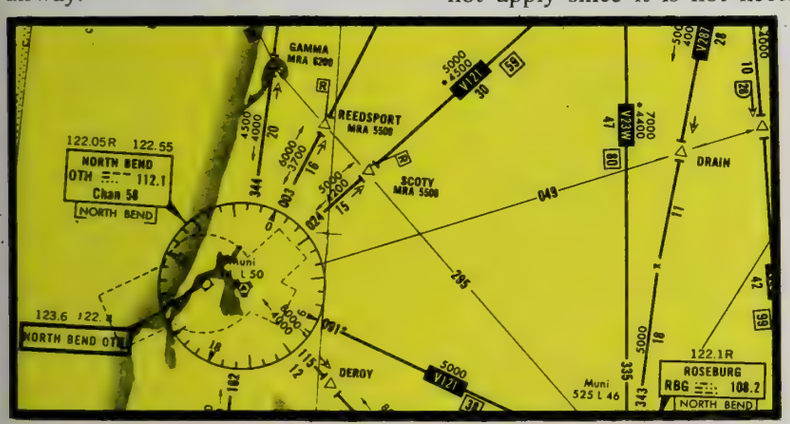
A. Any time reception of signals from a navigational aid, which is located off the airway being flown, may be inadequate at the designated MEA of that airway. The need for an MRA is determined by a flight inspection, which must be conducted prior to the establishment of the airway.

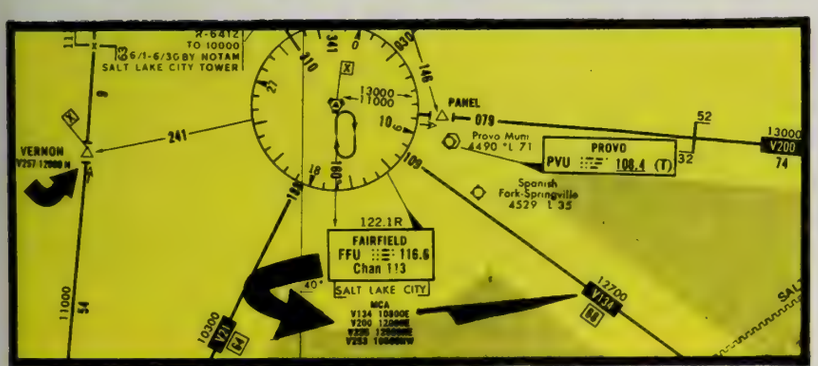
Q. How is an MRA depicted on the enroute IFR chart?

A. The letters "MRA" and the appropriate minimum reception altitude will be positioned in close proximity to the fix to which the MRA applies. If the fix is also a designated reporting point, a "flag" symbol containing an "R" will be attached to the reporting point. This is shown in Figure 4 at the GAMMA fix.

Q. In what instance(s) must a pilot comply with an MRA?

A. You must comply with an MRA whenever it is necessary to utilize a crossing radial to identify a fix. However, a DME fix arrow (15 ⟶ or ⟶) at a fix where an MRA is depicted, indicates that the fix may also be identified with DME. If DME is used to identify the fix, as shown in Figure 4 at GAMMA, REEDSPORT and SCOTY reporting points, the MRA will not apply since it is not necessary to receive the 295 radial from ROSEBURG VOR.





MIMIMUM CROSSING ALTITUDE

Q. What is a minimum crossing altitude (MCA)?

A. It is the lowest altitude at which an aircraft can cross a fix or navigational aid when proceeding in the direction of a higher minimum enroute IFR altitude (MEA).

Q. When should an aircraft climb to comply with an MCA?

A. Start your climb so as to cross the fix or facility, at which the MCA is depicted, at or above the published altitude.

Q. Where are MCA's depicted?

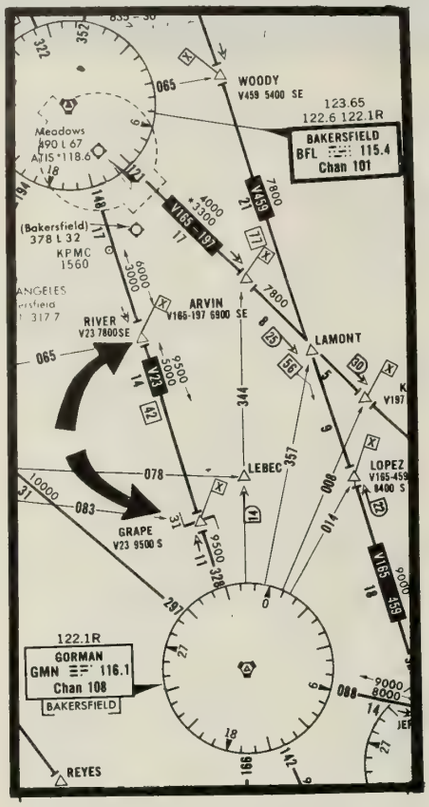
A. They are normally only depicted on low altitude enroute IFR charts.

Q. How are the MCA's depicted?

A. When an MCA is associated with a NAVAID or reporting point, it will be identified by a "flag" symbol containing an "X." In the case of a NAVAID such as the Fairfield VORTAC in Figure 5, the MCA will be identified by the letters MCA above the appropriate airway designation and number, the applicable altitude, and the direction of flight, e.g., V134 10800E. With reporting points, as shown at the Vernon fix in Figure 5, the letters "MCA" are not normally included and the other information is centered below the reporting point identification. If there are multiple minimum crossing altitudes associated with a fix or NAVAID, as is the case at the Fairfield VORTAC, the information may be consolidated under one listing.

Q. What criteria is used to determine when an MCA is needed?

A. An MCA is established when an obstruction would cause an aircraft to have less than minimum obstruction clearance during a climb



to a higher MEA. In order for the airway designer to determine if an MCA is required, he uses the following minimum climb rates versus flight altitude.

Sea Level through 5,000 feet 150 feet/NM
5,000 feet through 10,000 feet 120 feet/NM
10,000 feet and over 100 feet/NM

For an example of how the airway designer applies MCA criteria, refer to Figure 6. On V23 south of Bakersfield VORTAC, there is an MCA of 9500 feet at Grape intersection. The distance from Grape to River is 14 NM. The minimum flight altitude between the two points is between 5000 and 10,000 feet MSL so the minimum climb rate, from the preceding table, is 120 feet per NM.

To illustrate the computation, let's assume we need to determine the MCA at River for an aircraft flying SE on V23. To do this we multiply the minimum climb rate (120 feet per NM) by the distance from River to Grape (14 NM) and determine the minimum altitude change required (1680 feet). Then, subtract the minimum altitude change required (1680 feet) from the MCA at Grape (9500 feet MSL). This altitude (7820) is then rounded off to the nearest even hundred feet or 7800 feet MSL. When you see a route, or route segment, that has different MEAs for different directions of flight on that route, you should be aware that you are flying in an area of rapidly changing obstacle heights.

Q. Should a pilot maintain these climb rates when climbing to comply with an MCA?

A. Yes. These rates should be treated as a minimum. If you are unable to maintain at least these climb rates, then a climb to the higher altitude should be started earlier or a different routing requested from air traffic control.

Do you have a subject you would like to see addressed in "The USAFIFC Approach" article? Call us at AUTOVON 487-4276/4884. ★

Name That Plane



The first of the "B" category bombers, this early Army Air Corps twin-engine bi-wing bomber carried a crew of five. For answer see inside front cover.

366th Wins Daedalian Maintenance Award

Tactical Air Command's 366th Tactical Fighter Wing, Mountain Home AFB, Idaho, has won the 1976 Daedalian Maintenance Award. The trophy will be presented during the Order of Daedalians' annual meeting, 19-21 May in Denver, Colorado.

The Daedalian Maintenance Award was established in 1960 by the Daedalian Foundation to promote maintenance effectiveness and efficiency in the Air Force. The award, a large silver cup, was donated by Colonel Joseph A. Wilson, USAF Ret. The name of the winner and year of award are engraved on the base of the cup.

Lieutenant Colonel Joseph Sabin, Deputy Chief of Staff, Systems and Logistics project officer described this year's competition as "fierce." "All three contenders displayed an exceptionally high degree of professionalism, expertise and initiative in supporting their command missions. Strong leadership was evident at all levels," he said.

This year's winning maintenance complex is directed by Colonel Lee R. Wasmund, 366TFW Deputy Commander for Maintenance. The unit was cited for its high degree of professionalism and quality of maintenance.

During 1976 the 366th participated in and made a significant contribution to the success of several military exercises, including Jack Frost, Brave Shield XIV, Bold Eagle '76, Cope Train, Red Flag, Kangaroo II and the Korean Augmentation.

The 1975 award winner was the 436th Military Airlift Wing, Dover AFB, Delaware. ★

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TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



First Lieutenant

MILTON J. P. MILLER

74th Tactical Fighter Squadron
23d Tactical Fighter Wing
England Air Force Base, Louisiana

Lieutenant Miller was on a night ground attack upgrade mission in an A-7D. The flight entered the range and rendezvoused with the O-2 forward air controller who illuminated the target area with a flare. As the flare lit, all ground references disappeared, and the target area was obscured by a white, milky haze. During turn to downwind, Lieutenant Miller's main attitude direction indicator and heads up display began tumbling. He quickly rolled to straight and level flight on the standby attitude direction indicator. A quick cross-check of his performance instruments indicated the aircraft was climbing in excess of 4,000 fpm and the airspeed was rapidly decreasing through 250 knots indicated. The standby attitude indicator had also failed. Lieutenant Miller was now totally disoriented with respect to outside references. He advanced the power to military and succeeded in stabilizing the aircraft in level flight. Focusing on the turn needle, altimeter and vertical velocity indicator, Lieutenant Miller began a slow turn to allow Lead to join with him. Once joined, the flight executed a formation recovery. Lieutenant Miller's timely and decisive actions during a critical phase of flight prevented possible injury or loss of life and resulted in the safe recovery of a valuable aircraft. WELL DONE! ★



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NAME THAT PLANE

DOUGLAS B-18 BOLO

The Air Corps Bomber Competition of 1936 resulted in Douglas Aircraft Co getting an order for 177 B-18 Bolos. Quite similar in appearance to the famed DC-3 commercial airliner just coming off Douglas production lines, the Bolo was a very reliable, well performing plane. Although not exactly what proponents of strategic bombing desired, the General Staff felt it was adequate for the time, and 350 were delivered. A radar equipped version was used early in World War II for anti-submarine patrols. Other models of the B-18 were used to train bombardiers.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

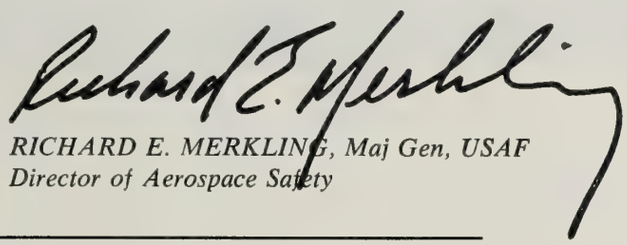
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JUNE 1977 AFRP 127-2 VOLUME 33 NUMBER 6

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There Is A Way

Annually the Air Force recognizes a given number of individuals, units, and commands for outstanding performance. This is good. However, competition for these awards is keen, and there is a very fine line between first place and also-ran. The winner receives a trophy, and no one ever hears again about those who didn't win. We want to correct that and see that all of those who did an outstanding job are acknowledged. Therefore, each month Aerospace Safety *will feature one or more individuals or units that were nominated but didn't win a major award. In this way, we can all share in recognizing the fine performance and dedication of those who came so close. Also, there are some excellent lessons to be learned and shared.*



RICHARD E. MERKLING, Maj Gen, USAF
Director of Aerospace Safety

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CAPTAIN CURTIS A. GRAYBURN

916th Air Refueling Squadron
Travis Air Force Base, California

The mission for Captain Grayburn and his KC-135 crew was to refuel a formation of four fighters flown by student pilots. All was routine until the final receiver encountered severe pitch oscillations and collided with the tanker.

After the initial confusion, Captain Grayburn noted that the aircraft was stable and holding cabin pressure, and did not have the crew bail out. The fighter crew, meanwhile, had ejected.

One of the receivers stayed with the tanker and reported the damage: a hole in the lower fuselage, damage to the left side of the stabilizer, tear in the left elevator, all but five feet of the boom torn off. There was major structural damage and fuel was leaking from the aft section. The loss of the boom caused failure of the right hydraulic system, leaving only partial spoilers and no nose wheel steering or powered rudder.

Captain Grayburn ordered the crew to keep their helmets and parachutes on, in case of an immediate bailout, and decided to head for Edwards AFB, California.

Edwards was close, with no populated areas enroute, and it has a 10,000 foot runway and several miles of dry lake bed suitable for rollout.

Upon arrival at Edwards, the navigator and boom operator lowered the flaps—a 20-minute job. A controllability check determined the aircraft could be flown safely if nothing else went wrong. A chase A-37 checked the aircraft configuration and flew chase throughout the approach. Control after landing was maintained with rudder, and differential thrust and braking.

Captain Grayburn at the time was a young aircraft commander with less than 250 hours since upgrading to aircraft commander. His performance and that of his crew were of highest caliber and resulted in saving a valuable aircraft and possibly five lives.

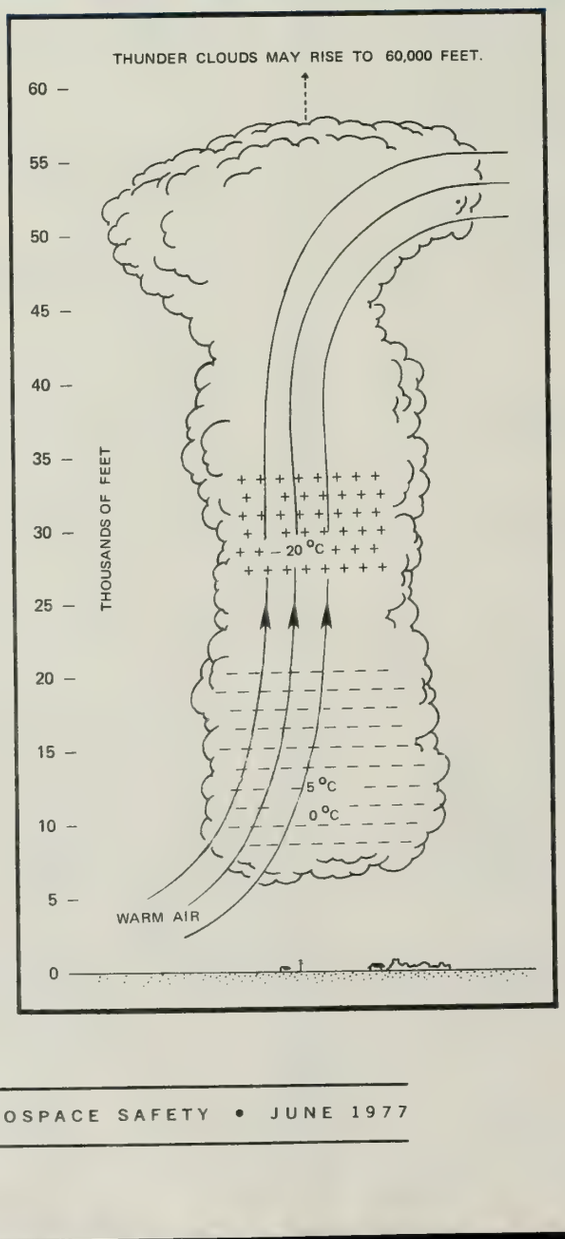
He was nominated for the Koren Kolligian, Jr., trophy. ★

Anytime you fly you are likely to become entangled with one of nature's most beautiful but awesome phenomena—lightning.

Even though April, May and June are the worst months for lightning strikes, some are reported in each of the other months, too, and so for some of you with many flight hours, these encounters may seem routine. But on very rare occasions lightning has brought a plane out of the sky, and on less rare occasions it has caused some very frightening close calls. Thus, it is well to review what lightning is, why your aircraft sometimes gets involved with it, what to expect from it, and how you can help researchers learn more about it and design even better protection from its effects in the future.

Lightning And

FIG. 1



A lightning flash is a very long electrical spark which extends between one center of electrical charge in a cloud and another center of opposite polarity charge in the ground, in another cloud, or sometimes even in the same cloud. The energy that produces lightning is provided by warm air rising upwards into a developing cloud as shown in Figure 1.

As the air rises, it becomes cooler and at the dew point its excess water vapor condenses into water droplets, forming the cloud. When the air has risen high enough for the temperature to have dropped to minus 40°C, all of the water vapor will have frozen to ice. Some of the ice crystals coalesce into hailstones which are heavy enough to fall through the cloud, gathering supercooled water droplets as they do so. According to one theory, as these droplets freeze onto a falling hailstone, small splinters of ice chip off, carrying away with them a positive charge and leaving the hailstone with a negative charge. The vertical air currents carry the ice splinters to the upward part of the cloud, leaving the base of the cloud with a negative charge center. The air currents and electrical charges tend to be contained in localized cells, and there may be several such cells in a single cloud.

Surrounding any electrical charge is an electric field which extends outward a long distance from the charge itself. Close to the cloud charge center the electric field is very intense, and when sufficient charge has accumulated, this field may be strong enough to *ionize* the air, creating a conducting path in the form of a luminous spark which jumps outward towards a region of

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FIG. 2



uncharged or oppositely charged air. Some of the charge from the cloud flows along this spark, charging up a column of air, perhaps a meter in diameter around the spark, and intensifying the electric field in front of it. This causes more ionization and further extension of the spark, and the process repeats itself for many extensions and forms a zig-zagging, luminous column of ionized air called the *stepped leader*. The leader zigs or zags about 50 meters in each step, travelling



MR. J. A. PLUMMER, General Electric Co, Pittsfield, MA

at about 100,000 meters per second, and pausing for about 50 millionths of a second between steps while it is supplied with more charge from the cloud.

As the stepped leader approaches the earth, it attracts electrical charges of opposite (positive) polarity and produces ionization from sharp objects such as tall buildings and trees. Fed by the attracted charges, sparks called *streamers* emanate from these points and propagate upward a short way to meet the downcoming leader. When the two meet, a conducting path is formed so that the charge in the leader can combine easily with the opposite polarity charges in the ground.

The process thus far takes only a few thousandths of a second to accomplish. When it begins, the leader moves in the general direction of an opposite polarity charge source, but it does not "know" where it will finally strike. There may be several possibilities, and the leader frequently splits into several *branches* on its way, as happened in the flash of Figure 2. The first branch that reaches a source of opposite charge completes the path and wins the race, so to speak. The leader that began the flash of Figure 2 found this opposite charge in the earth, but it might also have found it in another cloud, or even within the same cloud as the original source of charge. When the leader reaches the ground (or other opposite charge center), the positive charge in the ground rapidly flows into the leader, neutralizing the negative charge in it from the ground up. The head of the region in which this neutralization takes place moves up the leader channel at a velocity of 100 million meters per second—creating a current which reaches, on occasion, as high as 200,000 amperes. This current is called the *return stroke* and is responsible for the bright flash and loud noise we associate with lightning.

Once it reaches the cloud, the return stroke dies out but the charge remaining in the cloud may drain off through the conducting channel to ground, forming *continuing currents*. If additional charge centers are present in the cloud, they may also discharge to ground through the same channel, forming additional strokes, called *restrikes*. Neither the return stroke nor the restrikes last for more than a few thousandths of a second. The continuing currents are of lower amplitude—a few hundred amperes—but last for a much longer time than the strokes. Together, the strokes and continuing currents make up the complete lightning *flash* and flashes may persist for up to a full second. If more than one stroke occurs, the main channel will brighten during each one, causing the channel to flicker.

If your aircraft happens to be near a charge center or an advancing leader, the electric field around the aircraft may be intense enough to ionize the air about its extremities. This ionization often occurs in the form of a corona—a bluish glow visible at night and frequently called St. Elmo's fire. If sufficiently intense, streamers may also form and propagate outward from the aircraft toward the leader or charge center. As this happens, the intervening field will become even more intense and the leader may advance more directly to-

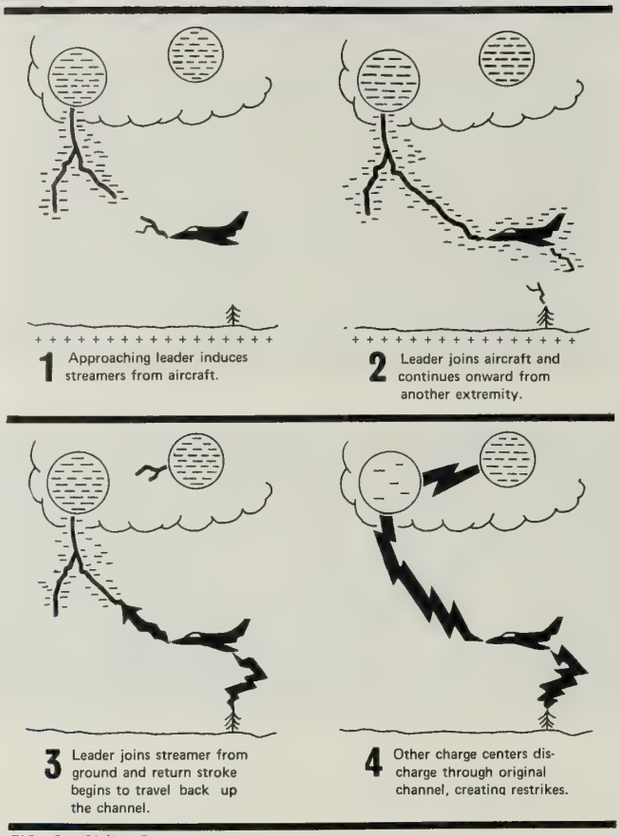


FIG. 3 Strike Sequence

ward the aircraft and meet one of the streamers emanating from it, completing a conducting path through which charge may flow onto the aircraft. Since there is not room for very much charge to remain on an aircraft, charge will "overflow" in the form of intense streamers from other extremities and enable the leader to progress onward, as shown in the sequence of Figure 3.

Thus, your aircraft becomes a link in the conducting channel from the cloud to the ground or another cloud. Whatever strokes and continuing currents pass through the channel will also have to be conducted through your aircraft.

Once within its clutches, you cannot fly away from a lightning flash. When the return stroke passes through the channel, you will experience the bright flash and loud bang so often reported. You will be "let go" only when the flash dies out naturally.

From your perspective in the cockpit, the foregoing events may appear to be caused by the aircraft becoming charged up by some other process and then suddenly discharging itself into the surrounding air, accompanied by a bright flash and loud bang. Sometimes at night the corona and streamering will persist and brighten for many seconds, appearing as a fluctuating column of fire snaking outward from the nose of the aircraft. When the flash finally occurs, the corona and streamering cease because the electric field has collapsed, and it appears as if the aircraft has suddenly discharged. Hence the event is termed a *static discharge* and not a lightning strike. However, a rather large amount of electrical charge is necessary to produce either a bright flash or a loud bang—far more than can be stored on an aircraft, so if either of these symptoms occur, you almost certainly have been struck by lightning. In fact, the loud bang does not even occur on some strikes; only a "whoosh" sound. This is thought to be a cloud-to-cloud flash whose return stroke occurs less rapidly, producing less current and noise.

WHAT PARTS OF AN AIRCRAFT GET HIT?

Since it will be part of a path between two charge centers, there will always be at least one entry and one exit point on your aircraft. *Initially,* these are places from which streamers came during the leader phase described earlier, and may be any of the extremities such as the nose, wing tips, horizontal or vertical stabilizer tips, tail cones and, somewhat less frequently, other protrusions such as propellers and blade antennas.

But, an aircraft flies quite a distance during the lifetime of the total flash, and this may expose other surfaces to flash attachment. A flash striking the nose, for example, may reattach at successive points along the fuselage until a trailing edge is reached, where it will then remain until the flash dies. If an initial attachment point was already at a trailing edge, the flash will simply hang on there. Figure 4 illustrates this process and shows other likely attachment points on a typical aircraft. *(Continued on page 22)*

FIG. 4 Lightning Attachment Points



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Colonel Olsen is a command pilot with extensive experience in tactical aviation. Prior to assuming his present position as Chief, Rated Officer Career Management Branch, AFMPC, he attended the Air War College and served a tour as an F-111 squadron commander.

WHAT'S NEW IN RATED ASSIGNMENTS? IN THE DYNAMIC ENVIRONMENT AFFECTING PRESENT AND FUTURE RATED FORCE MANAGEMENT, IT IS INDEED A CHALLENGE TO RELEASE BRAKES AND LAUNCH INTO A SHORT, MEANINGFUL DISCUSSION OF NEW ITEMS OF INTEREST IN RATED ASSIGNMENTS. MOST RATED OFFICERS POSSESS A FUNDAMENTAL UNDERSTANDING OF THE TRADITIONAL UNIT-MAJCOM-AFMPC INTERACTIVE ASSIGNMENT PROCESS IMPORTANT TO EACH OF US. THOSE ON BOARD THROUGH SOUTHEAST ASIA RECALL THAT WE NEARLY ALL HAD OPERATIONAL JOBS AND DID A LOT OF FLYING.

OF COURSE, SOME THINGS NEVER CHANGE. TOP PERFORMERS CREATE DEMANDS FOR THEMSELVES AND TEND TO PROGRESS RAPIDLY TO POSITIONS OF INCREASED RESPONSIBILITY. FORM 90S ARE A MOST IMPORTANT DOCUMENT AND RECEIVE FULL CONSIDERATION THROUGHOUT THE ASSIGNMENT PROCESS. BUT AS ALWAYS, AIR FORCE REQUIREMENTS ARE DOMINANT AND WILL BE FILLED—IN SOME CASES BY NON-VOLUNTEERS. WITH THAT BACK-DROP, LET'S LOOK BRIEFLY AT TWO IMPORTANT CONSIDERATIONS REGARDING WHAT'S NEW IN RATED ASSIGNMENTS?

COLONEL TOM OLSEN, Chief, Rated Officer Career Management Branch AFMPC



INCREASED OPPORTUNITY IN OPERATIONAL DUTY

THE ADJUSTMENTS REQUIRED TO SHIFT THE RATED FORCE TO A STABLE, PEACETIME FOOTING IN THE POST-SEA ERA ARE LARGELY COMPLETE. THE SIZEABLE SURPLUSES OF RATED OFFICERS IN SOME WEAPONS SYSTEMS IS DWINDLING RAPIDLY IN EVERY AREA AND IS COMPLETELY GONE IN SOME. OVERALL, THE TOTAL INVENTORY OF RATED OFFICERS IS MOVING RAPIDLY INTO BALANCE WITH TOTAL REQUIREMENTS. WHAT THIS MEANS TO THE INDIVIDUAL OFFICER IS THAT WE ARE INTO A PERIOD OF "FULL EMPLOYMENT" OF HIS RATED EXPERTISE. APPROPRIATE POSITIONS FROM UNIT TO HIGHER HEADQUARTERS WILL BE THE MAJOR GROWTH AVENUES FOR RATED OFFICERS. EVEN WITH PLANNED PILOT AND NAV TRAINING INCREASES ACROSS THE FYDP, DIFFICULTY MAY BE ENCOUNTERED IN SUPPLYING RATED OFFICERS FOR ALL REQUIREMENTS. IN KEEPING WITH THIS FORECAST, INDIVIDUALS WILL BE ASKED TO SERVE THEIR FULL ACTIVE DUTY SERVICE COMMITMENT. WITH THE REQUIREMENTS OF THE SOPHISTICATED, EMERGING WEAPONS SYSTEM SUCH AS THE F-15, A-10, F-16, AND B-1, FLIERS ON BOARD INTO THE MID-1980S FACE A BRIGHT FUTURE OF PLENTY OF OPERATIONAL JOBS, CHALLENGES, AND RESPONSIBILITIES.

INCREASED FOCUS OF AVIATOR CAREER MANAGEMENT RESPONSIBILITY

CREATION OF CAREER MANAGEMENT TEAMS FOR ALL RATED OFFICERS AT AFMPC IS NEARING COMPLETION. IN THE FUTURE THESE TEAMS WILL PROVIDE ASSIGNMENT SERVICES TO USING AGENCIES AND CAREER MANAGEMENT SERVICES TO INDIVIDUALS SIMILAR TO THOSE PROVIDED IN SUPPORT SPECIALTIES UNDER THE PALACE TEAM CONCEPT. INDIVIDUAL RATED OFFICERS WILL ENJOY INCREASED ABILITY TO PINPOINT RESPONSIBILITY FOR PRESENT AND FUTURE CAREER MANAGEMENT. THE TEAM WILL BE COMPOSED OF PILOTS AND NAVS "WHO HAVE BEEN THERE" AND THEY WILL BE ABLE TO GIVE YOU THE REAL ANSWERS TO THE QUESTION, "WHAT'S IN STORE FOR ME?" INCREASED BENEFIT TO THE AIR FORCE WILL BE REALIZED VIA REVIEW OF THE ENTIRE RATED FORCE TO ARRIVE AT THE BEST MAN-JOB MATCH POSSIBLE. ★

NEWS FOR CREWS

THE IFC APPROACH



WHAT'S IN A NAME

The new edition of AFM 55-9, Terminal Instrument Procedures (TERPS), has added several changes to the system for identifying an approach procedure. Since it will be quite a while before every Instrument Approach Procedure (IAP) reflects the new format, you should be familiar with both the new and old systems.

STRAIGHT-IN PROCEDURES

Procedures with straight-in minimums are identified by the type of NAVAID which provides the final approach course guidance, followed by the runway to which the final approach course is aligned.

Examples: ILS RWY 18, TACAN RWY 36, NDB RWY 21

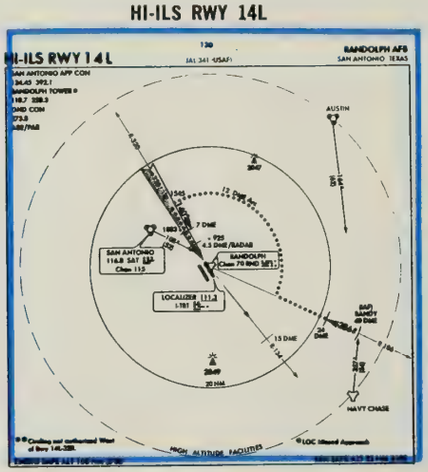
If there is more than one procedure serving the same runway and using the same navigational aid, each procedure will have a number following the NAVAID.

Examples. TACAN 1 RWY 36, TACAN 2 RWY 36

It is important to note that additional NAVAIDs may be required for maneuvering prior to the final approach without being listed in the approach name. For example: The HI-ILS RWY 14L (Figure 1) requires a TACAN to maneuver the aircraft to the ILS final approach course.

When there is more than one type of final approach guidance depicted on the IAP, the new and old systems of procedure identification differ.

Fig. 1
HI-ILS RWY 14L



Under the old system, if two final approach courses (defined by different NAVAIDs) were depicted on the same IAP, the NAVAIDs in the identification would be separated by a slash (/) such as: HI-TACAN/ILS RWY 15, see Figure 2. Also under the old system, if TACAN azimuth could be used on a "VOR" approach, "TAC" would be in parenthesis after the primary IAP identification, like this: VOR RWY 13 (TAC), as in Figure 3.

Fig. 2
HI-TACAN/ILS RWY 15

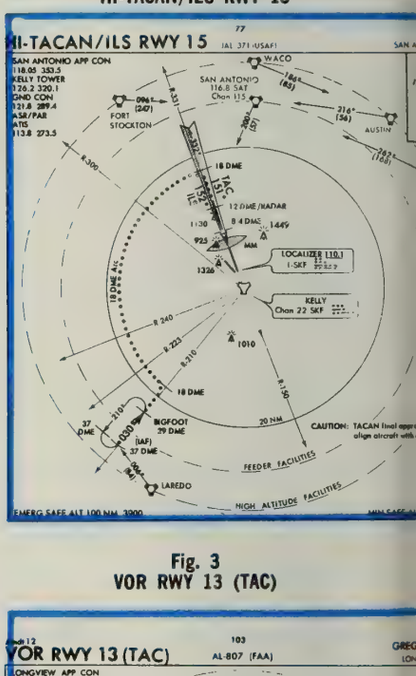
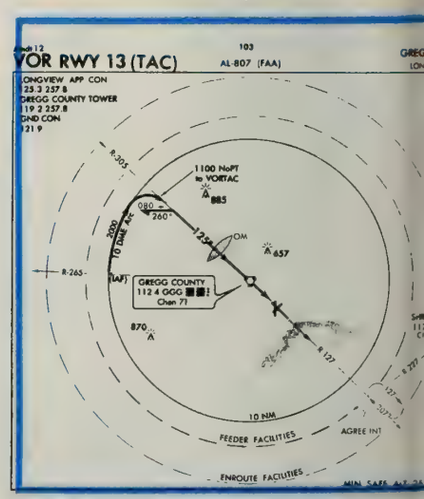


Fig. 3
VOR RWY 13 (TAC)



By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

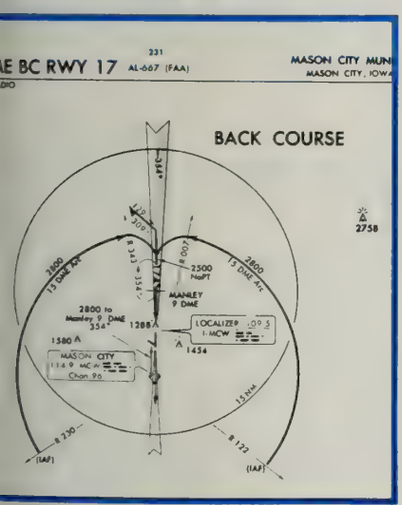
Under the new system, if two final approach courses to the same runway (defined by different NAVAIDs) are depicted on the same IAP, they will be separated by the word "or."

Examples: ILS or TACAN RWY 1, VOR/DME or TACAN RWY 36.

Under the new system, the slash (/) between two final approach NAVAIDs will indicate that more than one type of equipment must be used to execute the final approach.

Example: LOC/DME BC RWY 17, see Figure 4.

Fig. 4
LOC/DME BC RWY 17



Because both systems for identifying the IAPs will be with us for a while, reviewing your approach carefully becomes increasingly important. Let's look at the approach procedure in Figure 2 again, the HI-TACAN/ILS RWY 15. Depending on the identification system used, it could mean that there are two types of final approach guidance or that both TACAN and ILS are required to fly the final approach. A close study of the approach shows that either the ILS or TACAN can be used to fly the final approach course. Don't take anything for granted; study the approach and know what equipment you'll need.

Fig. 5
HI-NDB (UHF)-A

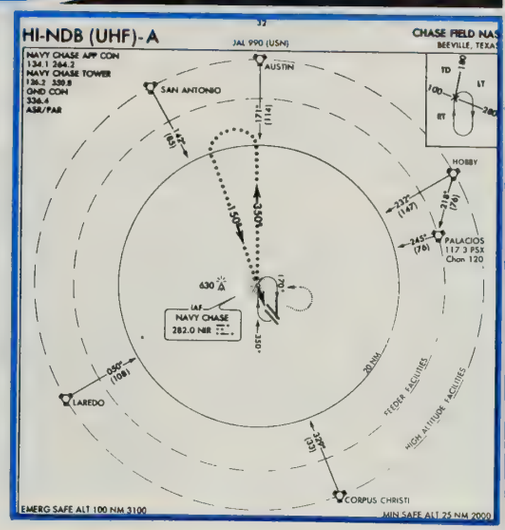
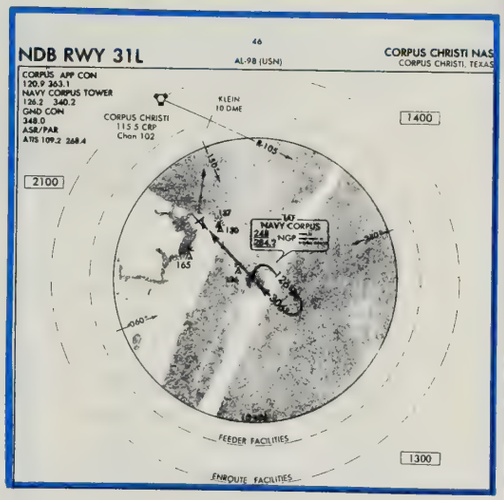


Fig. 6 NDB RWY 31L

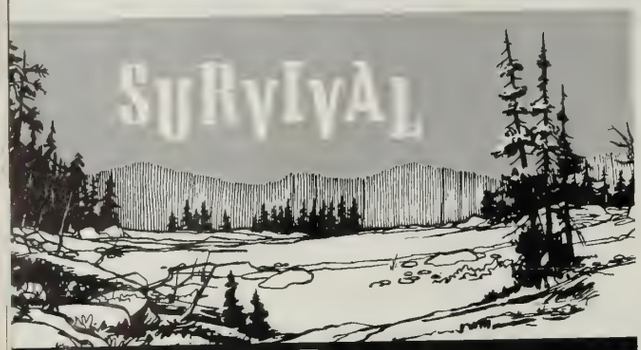


Procedures with only circling minimums will be identified by the NAVAID which provides the final approach course guidance, followed by a "letter suffix." NOTE: A circling approach procedure identification will never depict a runway. If there is only one circling IAP, the letter suffix will be "A"; if there is more than one circling IAP, the suffix will be alphabetical, in sequence, regardless of the final approach course NAVAID. An example of this sequence would be: VOR-A, NDB-B, VOR/DME-C.

The last approach identification we want to look at is the Non-Directional Beacon (NDB) approach using UHF frequencies. If an NDB approach uses final approach guidance from a UHF beacon, the IAP identification may have a "UHF" in parenthesis after NDB, as in: HI-NDB (UHF)-A, (Figure 5). However, not all NDB approaches which use UHF will have the (UHF) in the identification. Plan ahead by checking the planview of the approach to see if it can be flown using a UHF beacon. Look at Figure 6; in the frequency block, a 3-digit frequency, such as 248 (kHz), is the low frequency beacon and a 4-digit frequency, like 284.2 (mHz), is the UHF beacon. Either beacon can be used for course guidance.

What does all this mean to the pilot? It means that there may be more to the approach than is indicated in the name. Regardless of the identification system used, careful study of each approach will reveal any "hidden" requirements and keep the pilot informed, legal, and safe.

Do you have a question related to instrument flying? Call or write the USAFIFC/FSD, Randolph AFB, TX 78148. Our AUTOVON is 487-4276/4884. ★



fishing for food

CAPT THOMAS E. DILLON
Asst Chief, Operations and
Requirements Branch
3636th Combat Crew Training Wing
Fairchild AFB, WA

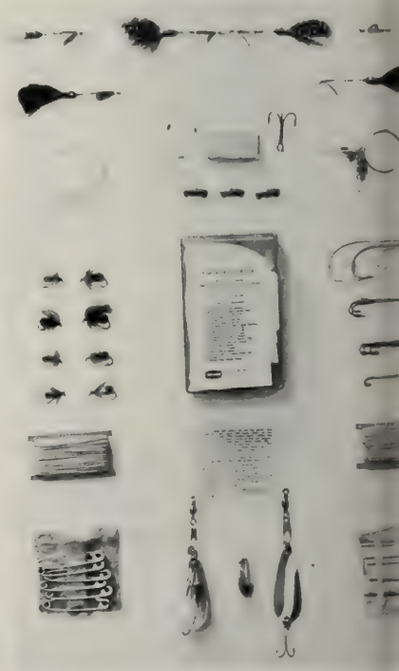
The evening mists are beginning to rise from a smooth stretch of the river bend, and that old, lunker trout silently rises to suck in a struggling artificial grasshopper from the mirror-slick surface . . . the glassy water far back in a lily pad-infested cove is suddenly torn apart by an eight-pound bass hitting your surface plug . . . scenes continue to change with kaleidoscopic swiftness as you recall some of the more memorable fishing trips of your boyhood. Finally, they all merge into a vision of freshly-caught fillets, browning in a cast-iron skillet with fried potatoes and hushpuppies. That's about all your stomach can stand, and you awaken to the sound of its hollow rumbling.

As you open your eyes, you see nothing but orange. It takes only a few moments for you to realize where you are, and that all of those memories were only parts of a frustrating dream. Yesterday afternoon, before you bailed out, you had been looking down at the many lakes and streams, wishing that you could have the opportunity to take a few days off to fish some of them. Suddenly, with alarming swiftness, the situation changed. Now, after a cold, hungry night under your parachute-nylon shelter, you realize that the opportunity is at hand; but this time, pleasure is not your primary motive for fishing . . . you must survive until SAR forces can pick you up, and that means shelter, warmth, water and food.

It also means signaling, but you took care of that problem yesterday before dark. Contacting rescue forces on your PRC-90 radio, you learned that help should arrive sometime late this afternoon—if the weather holds. Water is no problem, since there is a good-sized stream just down the hill. You laid out your ground-to-air signal last evening, and your signaling equipment is ready to use. You're not hurt, but you're hungry. With some time on your hands, you decide to try your hand at fishing.

Super . . . but what can you use? Looking through your seat kit, you find a small plastic box labeled FISHING KIT, SURVIVAL. Let's dig into the box and see what's available.

The components of the kit are listed on a card, visible through the clear plastic case. In addition to a small booklet of fishing instructions under survival conditions, the kit contains various hooks and sinkers, two sizes of line, a razor blade, leaders (both steel and monofilament), safety pins, needles, and a variety of artificial lures: eight assorted wet flies, six tiny feather jigs with willow-leaf spinners, a red and white spoon, a tiny copper spoon, and a larger, weedless spoon.



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Great, you think, there should be something here that I can use instead of having to improvise. Looking down at the stream, you notice that it's probably trout water —the kind of stream that causes some people to travel thousands of miles and spend thousands of dollars, just for the chance at wild-country trout. With a little fishing experience behind you, you realize that some of the kit's components will be almost useless for this stream's fish. As you walk down to the stream, you mentally discard the huge 9/0 hook and the large, weedless spoon; you ignore the steel leaders, as well as the spare snap swivels. The treble hooks probably won't help either, but you realize that they might prove useful for snagging a meal if the trout won't hit your lures.

You find a bunch of willows and cut yourself a pole, since it will enable you to cover more water than you could by hand-lining. You put away the 63-pound test line and settle for the 50 feet of 18-pound line, cutting off a length a couple of feet shorter than your willow pole. You secure the line to the pole, and open the leader packet. "Good grief!"

The nylon leaders must be at least 25-pound test, and you hope that the trout are hungry enough to ignore that highly-visible leader. You know enough about fishing knots to realize that the one illustrated for "attaching spinners, etc.," is a simple overhand knot, and totally worthless for your purposes. You recognize the picture of the Turtle Knot as sufficient, so you use it. An Improved Clinch Knot would be better, but the leader material is too thick and stiff to use those knots with the small lures. Recalling earlier fishing experiences, you straighten out the stiff kinked leaders by getting them wet and then stretching them.

Since you're in pretty "wild" country, you decide to try the small, copper spoon, flies, and jig spinners instead of wasting your time searching for live bait. "After all," you think, "those guys at Fairchild told me to conserve my energy, and I'd rather fish than hunt grasshoppers or dig worms." Good thinking, survivor! You're right. Just remember to put the items you're not using back into the kit, for you may need them later.

You're ready to try your luck, so you approach the stream and notice that there aren't any fish visible in the riffles. Looking both ways, you notice a small waterfall downstream and nothing upstream but more fast water. Downstream, then, will be the way to go.

Instead of merely stomping down the bank, though, you decide to circle through the brush and approach the stream again below the falls. This will prevent spooking the fish, and will put you into position from which you can flip your little lure upstream, letting the current carry it down through the pool below the small waterfall.

As soon as you reach the water again, you get down on hands and knees, trying to keep as low a silhouette as possible. You can't wait any longer, so you flip the lure up into the head of the small pool. Immediately, a chunky trout strikes. You attempt to set the hook, but nothing happens. Looking down at the spoon, you see that the small rivet which attached the hook has pulled out.

Tying on a small feather jig and spinner, you try again. This time all works well, and you soon have a nice, 15-inch Brook Trout flopping on the bank. Another flip, and a twin to the first is caught. Since rescue is imminent, you decide that you have enough. You clean and gill the two fish and take them back up to your shelter. A small, hot fire, and you roast the Brookies on a willow stick. Ever tasted fish that good before? Probably not, and there are a lot more of 'em in that little pool if the chopper can't get in today.

Obviously, the hypothetical situation just described is purely a figment of my imagination; the chances of a survivor finding such willing fish, with such little effort, are fairly remote. Even so, the fishing kit in your survival equipment could easily prove to be your primary source of food, should you ever find yourself in a situation similar to the one I outlined above.

It contains many items which can be used for a multitude of purposes: the razor blade, fishing line, needles, and safety pins could prove useful in any survival experience, whether water is nearby or not. The instruction booklet and other paper can be used for starting fires, and simple game snares can be made from the steel leaders; the large hook can be straightened out and made into a gig or spear, etc.

Even if you know little or nothing about fishing techniques, this kit can be very handy. With the instructions provided, you should be able to procure some tasty food with the components whether in fresh water or from a life raft on the open sea. Although it's far from perfect, the kit is adequate, and it definitely belongs in your survival gear. With a small, simple personal survival kit, you can easily supplement the stock kit with other items of your choice. I urge you to do so, and to carry it with you on all missions.

Who knows . . . even your NEXT flight could turn out bad, and you want as many things going for you as possible.

Questions or comments concerning this article should be referred to the 3636th Combat Crew Training Wing/DOTO, Fairchild AFB WA 99011 or AUTOVON 352-5470. ★

THE WAY I SEE IT



I had just pulled off the bombing target and was safing up the switches on our Phantom, searching the friendly skies for Lead. I knew I'd acquire him soon because the "brown and green lizard" sticks out like a sore thumb against a blue azure sky like we had today.

"Check right, 1 o'clock, 5 degrees high, 2 miles out" said Hal, my back seat pilot.

Immediately my eyes moved to the small patch of sky he so cryptically described. There was our leader. I keyed the mike, "Tally-ho, Lead, we're at your left, 8 o'clock closing."

"Roger, leader's sight caged, switches safe," he hinted for a response.

"Two's sight caged, switches safe," I radioed back. Releasing the mike button I asked Hal if it was his turn or mine for the rejoin. I felt the stick shake in my hands when Hal took control with the standard "I got it" call over the intercom.

"Roger," I said, taking my eyes off Lead to clear the area for other bogies. I checked deep six and continued my search; first 7 o'clock, then 8 o'clock, then 9. My mind wandered for a fraction of a second as I said to myself, "This is the last mission. I'll finally get over to SEA to do what I've been trained for—fly combat."

Back to reality. No bogies at ten, let me see how Hal's doing on the rejoin. As my eyes came off the left quarter panel I conveniently checked the airspeed, at 300 knots. I sure wish Hal would get off these darn pilot training, co-speed, pussy cat rejoins. My eyes came to rest on the Leader at a mile and a half range and I retracted my previous judgment. Hal's way ahead of the rejoin line (too much cut off) and he's going to "tiger" it in. I decided to devote full attention to the rejoin now for a couple of reasons. My personal preference is to come in on or slightly behind the line, 50-100 knots above rejoin airspeed, and having flown only seven missions with Hal I'm not positive that he has a technique for converting from his present position ahead of the line back to the normal rejoin. I knew if we maintained our present relationship it's likely one of three things would happen:

One, we could stay in this geometric plane, maintain our airspeed and overshoot.

Two, we could maintain the same plane and remain on the inside of the turn by reducing our airspeed drastically.

Three, we could maintain our airspeed, pull up nose high in the vertical and roll to the outside wing of the leader. This vector roll maneuver keeps you from overshooting Lead's radius of turn.

As I observed Hal proceed past the point of conversion to a normal rejoin, I immediately started looking for indications that he was going to perform one of the three options mentioned.

At 4,000 feet slant range I felt seat pressure as the nose started up. With the nose 20° high, Hal began a slow roll. We hit the wings level inverted position and passed canopy-to-canopy with number one. I anticipated an unloaded half roll to the upright position, but instead we continued a loaded roll. This was wrong. As our nose came through the horizon I advised Hal "Okay, we've messed up the rejoin, just abort it and pull us out of this mess."

As the word "pull" came out I recognized it as a poor choice of words. Immediately I felt four Gs and the aircraft shuddered. Being inverted he's buried our nose.

"I've got it!", I yelled. I unloaded and threw the stick full right. My mind raced! Why is it taking so long to roll? Check airspeed! Of course, the nose high pull up cost us 50 knots and Hal's ham-fisted pull cost another 50. We've got 200 knots. The rejoin was at 2,500 feet. It's going to be close when I get it upright. We're almost there! Analyze the situation, quick! Altitude 1,600 feet, dive angle 60°, airspeed 200 knots.

I set the bird at optimum angle of attack (AOA) and evaluated whether we can make the pull out.

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Too close. The decision is made. "Bail out, bail out, bail out" I commanded my back seater. I expected a blast of wind and a muffled explosion as his seat fired; instead I heard him over the intercom "I pulled the emergency harness release handle."

Oh great! He's just disconnected himself from his seat instead of ejecting. He's dead for sure if he tries to bail out now. We'll just have to hope we make it. I could see the ground coming up and fixed my full attention to the AOA gauge. As I stared at the gauge I thought of all the things we learned about AOA in aerodynamics at the Academy. I thought my coefficient of lift must be very high. I thought of the air foils I'd seen in the wind tunnel. I thought my induced drag is also high. I thought the wings were generating 1000's of pounds of lift. I thought. . . .

By now most of you pilots have said to yourselves "I'd never let that happen to me." Perhaps not, but loss of control cost us 11 aircraft in 1977. By loss of control I mean pilot induced departure from controlled flight.

There are several "operations" causes which could lead to a loss-of-control accident. They include pressing, overcommitment, lack of knowledge or proficiency, poor technique or lack of air discipline. In the case we've described at least three of these have a bearing.

Overcommitment

Hal was overcommitted when he moved ahead of the line. In an attempt to perform according to his image of "fighter pilot" he tried a maneuver for which he was ill-prepared. Any pilot can become overcommitted. Have you ever made a night IFR emergency recovery? Was it a bit "hairy?" The AC in this accident was overcommitted when he tried the recovery at less than 2,500 feet. The point is not that you shouldn't—but that you can become overcommitted. Be aware of the danger and avoid that final "coffin corner" situation.

Lack of Knowledge and Proficiency

Hal had neither the knowledge nor the proficiency to accomplish the maneuver he attempted. He also reverted to an earlier habit pattern when he forgot the proper ejection sequence for an F-4. In the current regime of minimum flying time each of us must be doubly alert to a loss of proficiency. The procedures trainer or simulator is your best remedy for this cause.

Poor Technique

This is a large "gray" area. Each pilot has his own cherished techniques for accomplishing the myriad of maneuvers necessary for a successful flight. And this is right and proper. It is only when technique is allowed to supplant the dictates of procedure and good judgment that it becomes poor. In this instance, the high cut off angle was a poor technique. Even the AC recognized that. The problem with technique is—where do you draw the line? This same technique used by the AC might have been successful. The answer is, make sure techniques are consistent with established procedures, then there will be little doubt.

Loss-of-control cost us more aircraft than any other single cause in 1976. And each of the underlying factors relates to everyday situations faced by pilots. The accident described in this article happened years ago. Yet the same type is still happening even in 1977. They will continue to happen as long as we—the USAF pilot community—continue to make these same errors. We can reduce this category of accidents. Let's strive to take control loss accidents out of the number one spot in 1977.

Ed Note: The mishap described in this article was contributed by Capt Ed Durocher, 33 TFW, Eglin, AFB, FL. ★

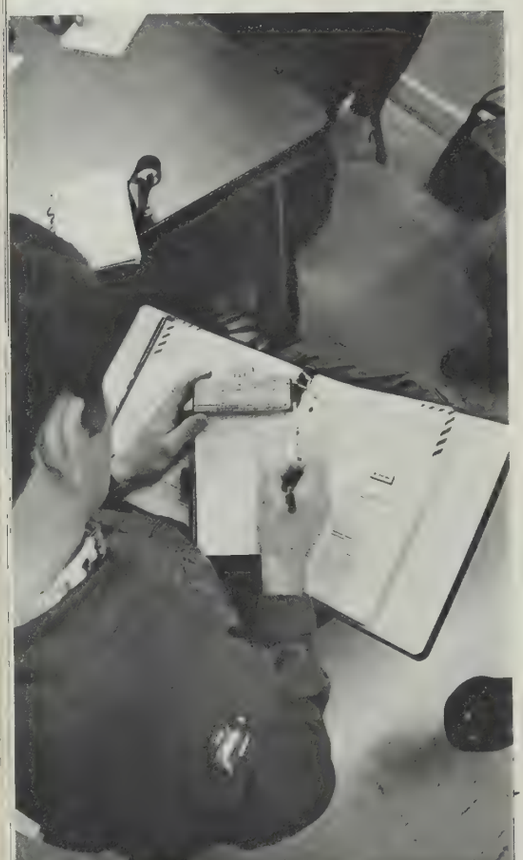


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DOVER AFB	Dover, DE
GRIFFISS AFB	Rome, NY
KI SAWYER AFB	Gwinn, MI
REESE AFB	Lubbock, TX
VANCE AFB	Enid, OK
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FAIRCHILD AFB	Spokane, WA
MINOT AFB	Minot, ND

The Specialized Pilot

MAJOR TONY HELBLING, Directorate of Aerospace Safety



During the past decade, the USAF has been driven to a universal pilot concept. The universal pilot, by definition, can be cross-trained into any weapons or support system as requirements dictate. This was required due to the long-term demands of the Vietnam era and remote manning requirements of our various weapons systems.

Our sister services, having different requirements, found they could maintain a specialized training concept on a broader scale than that of the USAF. The Navy, for instance, specializes within the undergraduate pilot training framework. When a naval aviator receives his or her wings, two-thirds of the training has been related to the type aircraft and missions to which the pilot will be assigned.

Specialization in the present USAF system starts when the pilot receives the aeronautical rating. USAF pilot training develops a pilot who is more qualified to fly a single-seat aircraft than a multi-crew manned system.

This lack of specialization has, in the past, been a frustrating experience for UPT graduates assigned to either type of aircraft. The fighter pilot is not exposed to tactical specialization prior to his rating. The transport pilot is similarly not exposed to multi-crew coordination duties and cannot be rapidly phased into this system without additional training.

In the fighter-attack business, the fix is a lead-in course which has recently been expanded to 49 sorties. This course exposes the UPT graduate to the tactical scenario in an aircraft he is familiar with.

The transport pilot would achieve the required level of proficiency by flying as copilot or third pilot.

The deficiency common to both situations has been slower integration into the end assignment weapons system. Now we are being driven to specialization by increased operational costs and lack of fuel.

An aircrew repeatedly flying the same type of mission such as air combat, close air support or tactical troop drop will become more effective at the specific mission. This gives the aircrew the ability to "fine tune" their procedures and techniques. On the other hand, a broad exposure to several types of missions will serve to bring the aircrew to the midpoint on the learning curve which does not enhance their effectiveness or significantly reduce the crew's accident potential.

In the final analysis, emphasis on specialization could prove to be the breakthrough in the reduction of operator factor mishap causes.

The article that follows describes the fighter lead-in mission. ★

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MAJOR JOHN E. RICHARDSON
Directorate
of Aerospace Safety

Where TAC's Tiger's LEARN TO GROWL

The morning sun starts to warm the white sands of the New Mexico desert; a Roadrunner stalks a particularly succulent lizard among the sparse vegetation at the edge of the dunes. Suddenly, the early morning calm is shattered by the roar of jet engines. Two sleek, blue-gray shapes flash overhead. The Roadrunner unconcernedly looks up and sees a second pair of T-38's lifting from the runway at Holloman AFB. The bird watches as the four aircraft join up and streak out toward *El Capitan*.

So starts another mission for one of TAC's newest and most important wings. The 479th Tactical Training Wing has the responsibility for training new pilots and navigators before they report to an RTU. The 479th's history makes it well suited to training new fighter aircrews. First activated in October 1943, the 479th Fighter Group distinguished itself throughout Europe in both P-38's and P-51's. The Group was deactivated from 1945 to 1952 when it was designated the 479th Fighter Bomber Wing at George AFB, California. From then until 1971 the wing flew many of TAC's first line fighters: F-86's, F-100's, F-104's, and F-4's.

The heart of the 479th's mission is fighter lead-in training. The

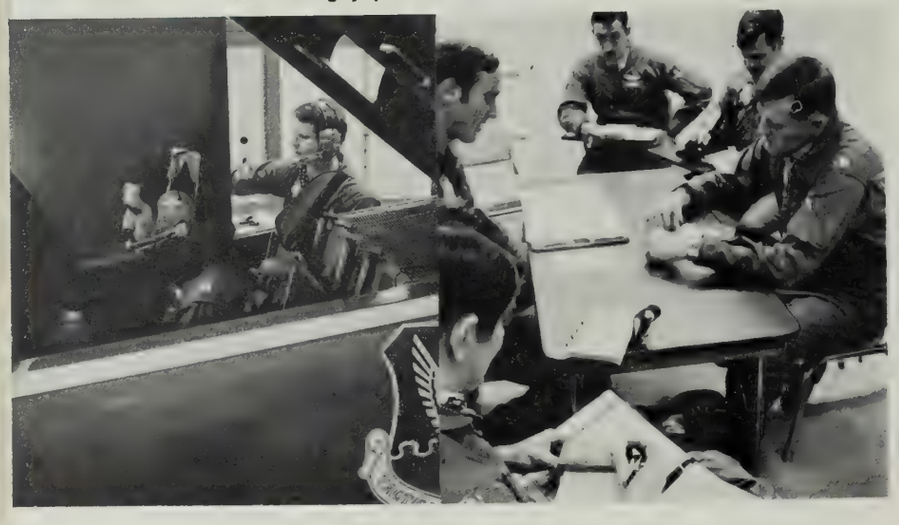


course is designed to train recent UPT and UNT graduates and other aircrew resources without a TAC background in fighter tactics and procedures. The course concentrates on basic fighter maneuvers and ground attack using T-38 and AT-38 aircraft. There is also a comprehensive and demanding academic program. The academics are designed to compliment each phase of the flying training.

Why have a special fighter lead-in program before RTU? The answer is economics and safety. Colonel William Crum, the commander of the 479th, emphasizes that the mission of the wing is to give TAC the best possible aircrews at minimum cost. This means the least costly aircraft that can provide the required training objectives. The T-38 is remarkably suited to accomplish this; its cost per flying hour is only about 20 percent of that for an F-4 or F-15. The training currently being given in the



The fledgling fighter crews learn the basics of fighter tactics and aircraft operation from highly qualified instructors.

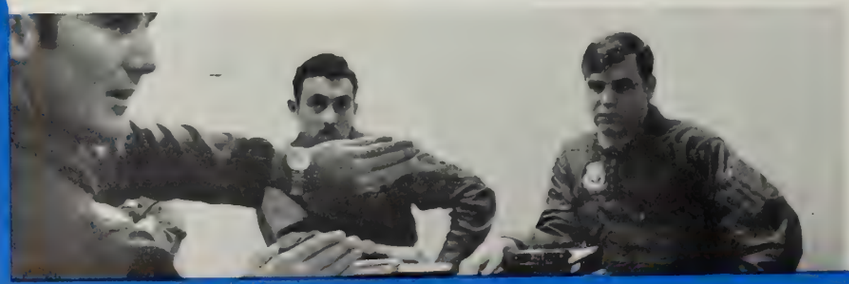


imulator training in both T-38 and F-4 simu-ators is an important part of the training rogram.

Detailed briefings are a prelude to every flight. All crewmembers must be very familiar with every aspect of the flight.



Capt Jim Slaton of the 435th TFTS explains an important point about tactical formation during a flight briefing. Careful and explicit instruction keynotes each 479th flight.

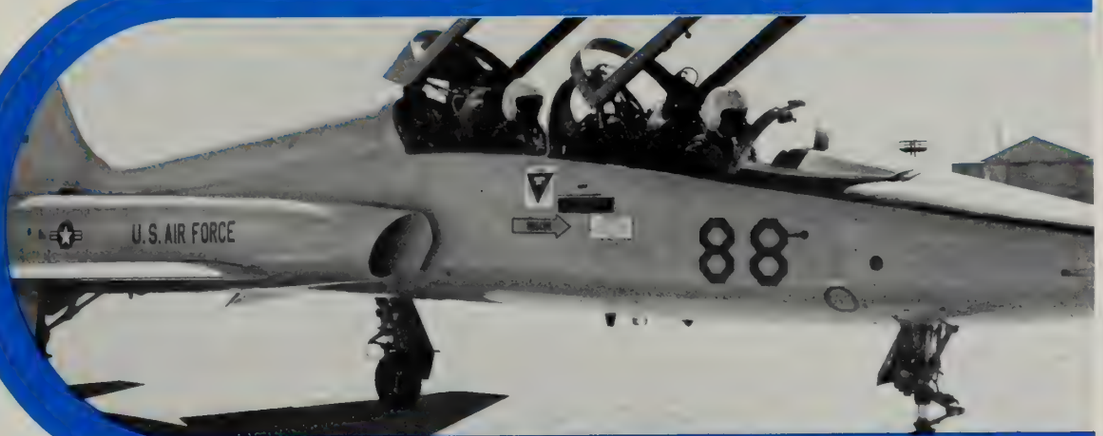


fighter lead-in syllabus has enabled the F-4 advanced fighter training to be reduced by four sorties. The savings from this reduction is more than $5,000 per student.

But aircraft cost per flying hour is only part of the story. The real savings is in training effectiveness. The UPT/UNT graduate reporting to an F-4, F-15 or A-7 RTU is faced with an awesome learning task. First the trainee must learn the highly specialized and extremely demanding skills of a tactical fighter crew member. But this is not enough —at the same time he must master the complexities of a new first-line combat aircraft.

The logical solution is to reduce the learning work load. This is most easily accomplished by eliminating one of the variables. Since all UPT graduates are already familiar with and qualified in the T-38, this is the most feasible solution. Now a trainee can concentrate on learning the basic maneuvers and tactics he





"Pegtop Flight Check In." A precise professional check in sets the tone for every 479th flight.



Flight taxies out for a basic fighter maneuver mission, one of the important phases of the course.



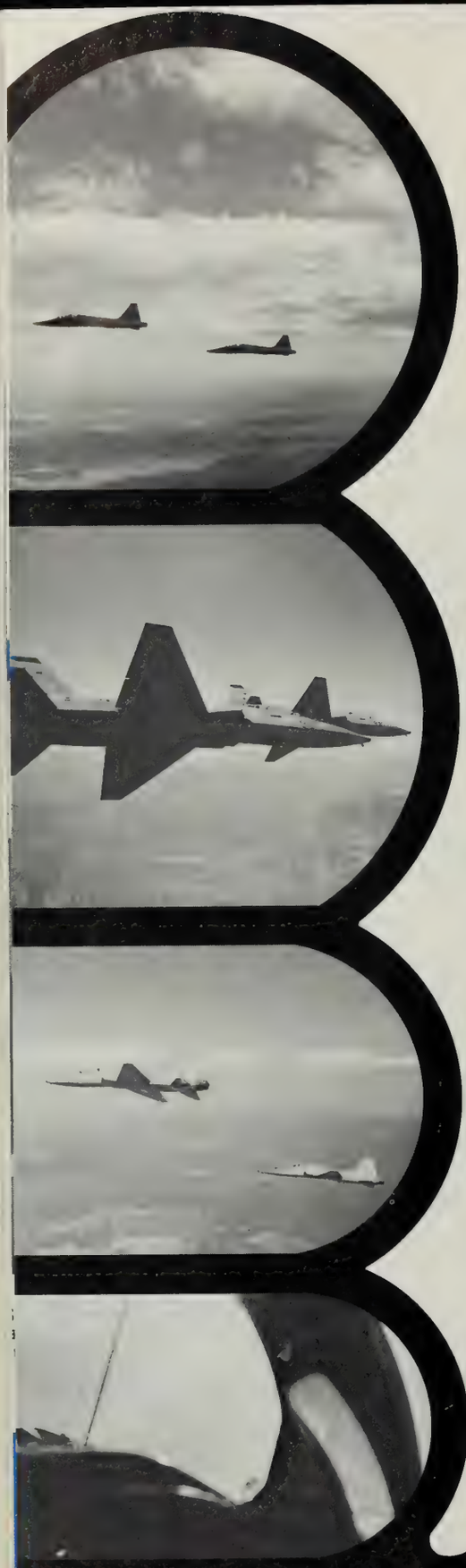
Last chance inspection—that final assurance that everything is ready to go.



On the runway—the flight lines up and takes off in two-ship elements.

will employ in a fighter without being overloaded. This concentration also allows for much better retention of the material and then, when the trainee goes to advanced training, he already knows the language and basic maneuvers. The advanced training can, therefore, be just that —a polishing of the skills of a fighter aircrew.

We mentioned safety. This is a cornerstone of the fighter lead-in course. The fighter mission is demanding. There is little margin for error in tactical flying; consequently, the new fighter crew must have safety ingrained as part of their training. This does not mean using the old "fly safely" bromides. Rather, the approach is one of discipline and expertise in mission accomplishment. It is a realization that true flying is nothing more or less than doing the job correctly, efficiently,





Now we get to practice what we briefed on the ground. Tactical flying is a demanding but very rewarding mission. The satisfaction of flying a well executed tactical maneuver is about the best you can get.

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professionally. This point is continually emphasized by the instructor. An accident means loss of combat capability, thus safety is important.

Combat is something the 479th instructors know about. Most are long time fighter types, some with 500 combat hours and even one with more than 1000. Their creditability in teaching the business of fighters is excellent for they've been there. Now they are passing on that hard won knowledge to a new generation.

The New Mexico sun climbs higher in the sky. The desert begins to shimmer reflected heat as midmorning approaches. The Roadrunner, remembering his earlier repast, is looking for another lizard. Across the dunes comes the increasing rumble of jet engines. Two pairs of T-38's flash over the desert in fingertip formation. Each one, in turn, arcs into a tight pattern over the runway and descends gracefully to touchdown.

The Roadrunner watches as the T-38's taxi back to parking. This is the last flight for these students. They have completed the lead-in course and now go on to advanced fighter courses in A-7's, F-4's or F-15's. Four new TAC Tigers have learned to growl. ★



Learning to land a high speed fighter is a difficult task. By using an aircraft already familiar (T-38), this stumbling block is avoided, and the trainee can concentrate on tactics.



Mission accomplished. Another crew has learned the skills necessary to prepare them for their future roles as first-line members of TAC.



THE SECOND FIRE WARNING LIGHT or, WHAT DO I DO NOW?



This article is reproduced courtesy of McDonnell Aircraft Co Product Support Digest

By BOB JENSEN/*Senior Engineer, Flight Safety Department*

In twin-engine fighters like the Phantom, a single fire warning light isn't the heart thumper that it is in a single engine machine. Not that it doesn't attract a lot of attention and demand rapid action, but there are ways to cope with the problem and bring the airplane home. Phantom Phlyers have seen their share of fire warning lights, both false warnings and the real thing. They . . .

> "Idle the affected engine, then proceed to cut-off if the light continues or a fire is confirmed."

This should take care of the problem, requiring only a no-sweat single engine landing if there are no additional complications. However, one of the rarer added thrills for the pilot is a *second* fire warning light from the other engine bay. Here we have a hopeless situation - fire in both engines and nothing to do but eject, right? Perhaps, but not necessarily, and certainly not before you know for sure what is really going on down there in the engine room.

FIRE WARNING INDICATIONS

First, let's consider what the fire warning light is saying. The detection element is designed to pass enough current through an electrolytic salt to start the fire light glowing when a temperature of 766°F is attained on any segment of the fire detection elements. This temperature is high enough that normal engine heat will not cause a warning light, and low enough that a warning comes before major fire damage has occurred. A temperature of 800°F will not cause immediate serious structural damage in the engine cavities. Like the pain in your hand when you touch a hot stove, the fire warning usually comes before serious damage is sustained. So the second fire warning light is not a cause for instant despair.

FIRE WARNING IMPLICATIONS

Second, let's examine the history of F-4 accidents where a second fire warning has occurred. (In this part of the discussion, only *fire* warning lights, as distinguished from *overheat* warning lights, are considered. There is a very good reason for this distinction, because a fire warning light reports a 766°F temperature condition *inside the forward and mid-engine cavity,* while an overheat warning light reports a 1050°F condition *outside the engine bay* at the "turkey feathers.")

There are some variations in the double fire light accident patterns, mostly in the time interval between the first and second fire lights. The cases on record where nearly simultaneous fire lights occurred immediately after takeoff almost invariably involved F-4's with *centerline external fuel tanks* installed. Although investigators did not always agree that a leaking centerline tank connection was the cause, the circumstantial evidence is overwhelming.

The few exceptions that involved near simultaneous dual fire lights had entirely different characteristics. Most importantly, they did not occur just after takeoff. Each of the exceptions also had clear-cut catastrophic failures indicated. In one case, an early configuration titanium first stage engine compressor disc failed, causing major shrapnel type damage and a series of explosions. Another case occurred on centerline rack cartridge firing, when a poorly secured jettison cart housing punched a hole in an engine fuel line in the keel. Another similar case was a result of jettisoning external stores.

But on liftoff, or initial climb after takeoff, a double fire warning with a full centerline tank installed calls for C/L tank jettison, or depressurization by extending the IFR receptacle door/probe. If accomplished promptly, centerline tank depressurization/jettison may eliminate the fire.

SEQUENTIAL WARNING LIGHTS

A different situation exists where first one engine fire light comes on, and *following throttle reduction* to idle or cut-off, the other light then comes on. Here we have a definite fire origin within one engine cavity that is transmitting enough heat to the other engine bay to trigger that fire light as well. Does this mean that the fire has spread so that both engine bays are involved in the fire? Not always; perhaps we can even say not usually.

If we consider only fire warning lights again, with no overheat lights illuminated, F-4 history says that only the one engine bay is really involved. Post-accident examination of the engine bays with this condition normally shows little or no evidence of fire in the engine bay that had the second light. The reason for the second light is that sufficient heat from the primary fire was transmitted through the center keel web to heat the fire detection element in the other cavity to 766°F.

In one or two cases, it has been theorized that because right engine bay fire elements are mounted directly to the single titanium keel web above the 83R door, a fire properly positioned in the left engine bay could direct enough heat on the web to cause a right engine fire warning as well. In other accidents with these symptoms, it has been found that hot gas and flame found a path through web openings, such as the centerline bomb rack (AERO-27) access doors, into the other engine bay. Though the damage in the second cavity was normally limited, i.e., scorched paint, the temperature was high enough to cause a fire warning.

The J-79 engine installation uses a large-volume, high-velocity flow of secondary cooling air outside the engine and inside the engine bay. This is provided by the jet pump action of the engine exhaust nozzle during engine operation. Inside the engine bay of an operating engine, and especially during engine acceleration, air pressure is less than in the air outside the cavity. This is how a leaking external centerline tank can trigger one or both engine bay fire warning lights. The leaking fuel is drawn into engine bays, ignited in the A/B flame at the nozzle, and fire flashes back into the engine bay.

If, however, the pumping action of the engine exhaust nozzle is stopped in flight by engine cut-off, the normally negative relative pressure inside that engine bay becomes positive. Ram air, entering the engine intake, spills through the opened bellmouth into the engine bay. Due to the termination of nozzle pumping and a restricted exit area, a pressure increase occurs in the engine bay. If one engine is idled, a similar but lesser pressure rise occurs in the engine bay of the idled engine. Thus, when one engine is idled or shut down in response to a fire warning light, any opening between the engine bays becomes a "pneumatic tube" to draw the fire into the other side. As engine shutdown cuts off all but residual JP fuel and a few gallons of hydraulic fluid and engine oil, the fire has little chance to seriously involve the second engine bay. However, it will cause the second fire warning.

OVERHEAT WARNINGS

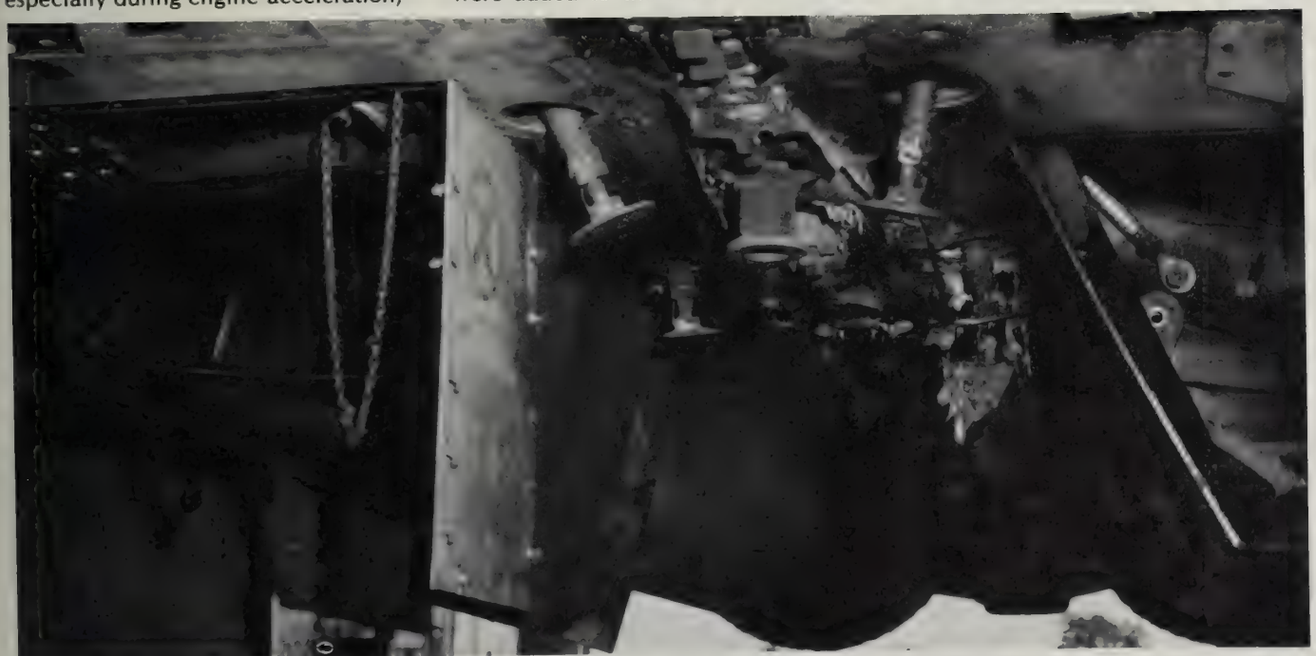
To complete the picture, let's examine the accidents where overheat lights were involved. These are indications of high temperature outside the engine exhaust nozzle, where sensors were added to the F-4 to warn of a nozzle flap failure. A single overheat light, with no other fire indication, is usually just that, a nozzle flap failure.

Two overheat lights alone (no fire warning) are a different story - that usually means fuel is burning at the tail in such quantity as to light both lights. An upper fuselage fuel system leak, as from a fuselage fuel transfer line failure or a fuel cell rupture, normally does not enter the engine bays. Fuel streaming aft, from an airframe fuel system leak outside the engine cavity, will not ignite until an ignition source is encountered. Historically, engagement of afterburner has been the most frequent and most positive method of igniting leaking fuel. So, if two overheat lights come on shortly after A/B selection, probably a major fuel leak exists.

If one fire light follows (or precedes) the two overheat lights, there is a likelihood that the fuel is originating in the engine bay that has the fire warning, and immediate shut-down of that engine may control the fire. Some types of catastrophic engine failures, however, can rupture a fuselage fuel cell from below causing an uncontrollable fuel leak/fire from the engine bay. In any fire in which both overheat lights are on, there is a possibility of loss of stabilator control due to fire progression inside the aft fuselage.

USING WHAT WE NOW KNOW

The history of F-4 fire accidents is well worth examining for the purpose of learning whether cockpit indica-



A centerline tank leak on takeoff gave the crew two fire warning lights and an overheat light to analyze. After alternate throttle reduction did not help, tank jettison solved the problem. (All photos are of same aircraft)



This right engine bay center keel web was bright blue, showing 1100°F+ flame temperature. Note fire warning loop mounted to titanium web skin.

tions can be used to discriminate between types of fires. This summary is an effort to pass on the knowledge available; however, none of these typical indications can be considered absolute indicators of the fire source.

Even though analysis of fire and overheat warning light sequencing is not an exact science, the record shows that a particular warning light sequence can be meaningful. So, how can a pilot, maintenance supervisor, or mechanic use this information? As a pilot, I would make a mental note that with a centerline tank installed, a double fire light just after breaking ground might be cured by tank jettison, or even by nothing more than extension of the IFR receptacle/probe. Even a single fire light at that point would make me think — centerline tank? I would also make certain that, on preflight, the AERO-27 (centerline) rack access doors are installed and secure. Without becoming complacent about engine bay fires, I might also remember that, statistically, the record shows a single fire light followed by a second fire light after cutting the throttle on the first engine, probably means heat transfer from the initial warning area. Completion of engine shutdown as dictated by the first fire light might eliminate both problems. If both lights persist, or the second one goes out and the first remains on after engine cut-off, the odds are good that a Utility hydraulic line is the fire source. In several accidents of this type, the fire ran out of hydraulic fluid and went out at about the same time the crew ejected.

In the aircraft maintenance group, the knowledge that keeping the keel web airtight can save an airplane and crew may improve the incentive to watch AERO-27 access doors more carefully. Other keel openings may also be detected that require resealing. Meticulous leak-checking of centerline fuel tanks after installation can also save a crew and airplane. The fact that these tanks only pressurize for transfer after takeoff is the reason a careful leak-check is required *with the tank pressurized*.

Engine bay fires are serious problems in the F-4, and our twin-engine redundancy needs to be protected so that a fire in one engine can be contained and possibly eliminated. Better understanding of the causes and progression of fires may result in saving some aircrews and aircraft.





Jettison of three external tanks to reduce landing weight also got rid of the source of the fire. The crew brought this one back after an adrenalin-filled eight minutes. Photo on right shows centerline bomb rack from below. ■

Caffeine Comments

Air Command Headquarters
Canadian Forces
Westwin, Man



Caffeine is a common drug found in a variety of plants, most notably coffee beans, tea leaves, cocoa seeds and cola nuts. It is closely related to a variety of chemicals, including uric acid (the causative agent of gout), purines (a major constituent of DNA in cell nuclei), theophylline and aminophylline (for treatment of asthma) and theobromine (the major stimulant in cocoa). Of all the chemicals of this family, caffeine has the greatest stimulant effect on the central nervous system, especially the cerebral cortex. It also causes the kidneys to increase fluid output, stimulates the heart to beat faster and relaxes smooth muscle (e.g., the bronchi or respiratory tubes).

Of all these effects, we drink coffee for its stimulating effect on the central nervous system. Caffeine, through the central nervous system, does a variety of "good things": It allays fatigue and drowsiness, allows sustained mental effort, gives a keener appreciation of sensory stimuli, decreases reaction time, enables a clear flow of thought, increases motor activity and enables greater association of ideas. Through other avenues it also increases the muscular capacity for work, increases secretion by the stomach and increases respiratory rate, among others. Although tolerance to all these effects does develop, the stimulant effects seem least affected.

Since a variety of food products are made from the plants that contain caffeine, many commonly consumed beverages and snacks have fairly high levels of this drug. Also, since caffeine does have the physiological effects referred to above, it appears in a host of commonly-prescribed and proprietary medicines. Following is a list of the commonest sources of caffeine on the market today, with approximate contents of caffeine:

1. Beverages	Caffeine Content
Brewed Coffee	90-150 mg/6 oz cups
Instant Coffee	80- 90 mg/6 oz cups
Tea	70- 80 mg/6 oz cups
Hot Chocolate*	20- 50 mg/6 oz cups
Colas	35- 55 mg/12 oz btl

*Certain types do not have any (e.g., Ovaltine R)

2. Medications	
Frosst Pain Killers (e.g., 222, 292, etc.)	30 mg/tablet
AC &C (Ayerst)	15 mg/tablet
Anacin R	32.5 mg/tablet
Coricidin Cold Tablets R	30 mg/tablet
Sinarest R	30 mg/tablet
Bromo Seltzer R	32.5 mg/tablet
Excedrin R	60 mg/tablet

In addition, certain chocolate preparations and Dristan R also contain significant amounts of caffeine.

Although caffeine has many good side effects, too much of the proverbial "good thing" has undesired, adverse, and often deleterious effects. When one consumes enough caffeine to get side effects, the condition becomes known as caffeinism, and most of us have probably had this entity on occasion. The symptoms of caffeinism are legion, and include the following: irritability, shakiness, muscle twitching, inability to sleep, nervousness, rapid breathing, flushing, rapid heart rate, irregular heart beats and palpitations, frequent urination, abdominal cramps, diarrhea, and acidy stomach with heart burn. Most of these effects are due to the stimulant properties of caffeine, again the reason we drink coffee or tea in the first place.

The development of these symptoms and the dose of caffeine required to produce them depends on the individual. On the average, however, 50-200 mg of caffeine is usually enough; therefore, two cups of coffee or tea could produce unwanted effects, and so could the drinking of several colas.

To avoid the adverse side effects alluded to above, a lot of people are switching to decaffeinated coffee. However, there is evidence that caffeine is not the only offending constituent in coffee, albeit the principal one. Thus, people who switch to decaffeinated coffee may still witness some, or all, of the unwanted side effects. Morever, other heavy caffeine consumers, alarmed by articles such as this have ceased their intake abruptly. This has resulted in a physical withdrawal with such symptoms as irritability, headaches, shakiness and a variety of others. So, if you decide to break the caffeine habit—let's call it what it often is, a caffeine addiction—let yourself down slowly, or stop under the care of your Flight Surgeon. Although we often don't take caffeine seriously, we should!

To stop drinking coffee would be extreme, and probably not warranted. However, to be aware of what one is consuming, and to practice moderation, seems to make sense no matter what we are doing, especially flying. And this is especially so if the results of immoderation adversely affect performance—indeed be downright incapacitating — as they can be in the case of caffeine. ★

LIGHTNING AND AIRCRAFT

continued from page 4

CAN YOUR AIRCRAFT TRIGGER A STRIKE?

A question often asked is, "If an aircraft cannot produce its own lightning flash, can it trigger a natural one?" Stated another way the question might be, "Would the lightning flash have occurred if the aircraft were not present?"

While there is still much we don't understand about lightning formation process, most researchers conclude: (1) that aircraft are usually struck by flashes that would have occurred anyway, but (2) the aircraft, being conductive, is attractive to a nearby leader and causes it to divert towards the aircraft rather than continue on in some other direction. There is some evidence that jumbo-jets sufficiently "squeeze" and intensify the electric field around a nearby charge center to cause a stepped leader to form before it otherwise would have, thus triggering a strike; but this seems improbable for smaller aircraft.

WHEN IS A STRIKE MOST LIKELY?

Erratic as they are, it is impossible to predict just when or where a lightning strike will occur, but some idea of when to be on the alert for one can be obtained from study of past experience.

Figure 5 shows flight and weather conditions summarized in a recent survey of 200 commercial airline strike reports, and Figure 6 shows the flight altitudes at which most of these aircraft were struck. The outside air temperature reported in most instances was within a few degrees of the freezing point (0°C). From this data one might draw the conclusion that a strike is most probable to an aircraft flying at an altitude between 10,000 and 15,000 feet, within a cloud, experiencing rain and light turbulence and with the outside air temperature near 0°C. Strikes have been reported under many other combinations of circumstances, however.

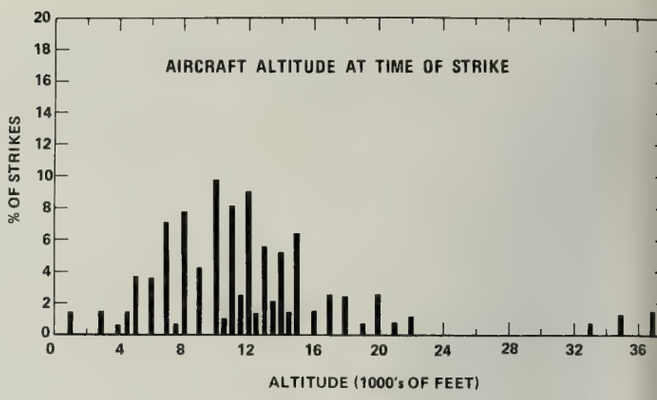


FIG. 6 Altitude Where Most Strikes Occur

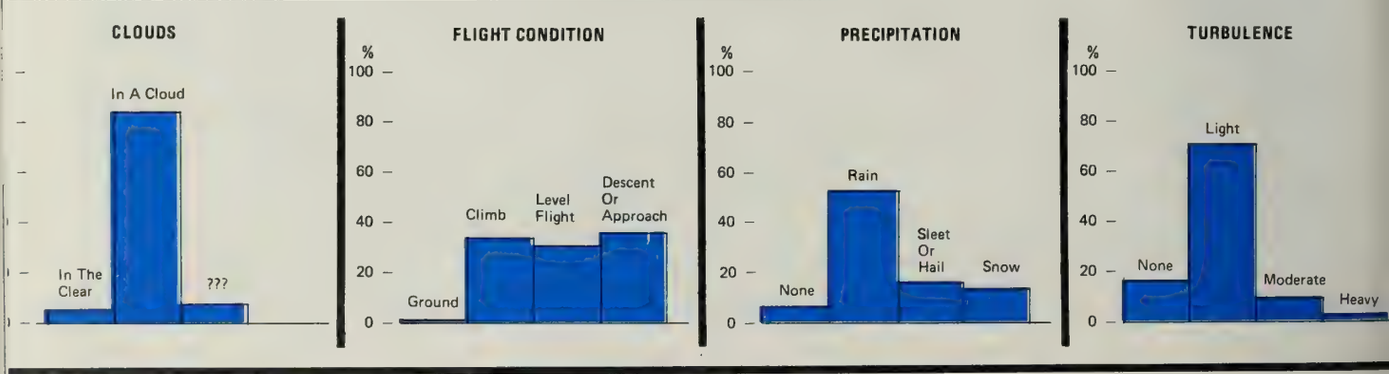
WHAT ABOUT AVOIDANCE?

Good flying practice and USAF flight manuals call for avoiding thunderstorms at all cost—not only to avoid lightning strikes but also to avoid the other manifestations of a good thunderstorm: turbulence, hail and rain. Careful study of weather reports and use of radar can help you avoid areas of precipitation, but unless you can circumnavigate these by well over 25 miles, an occasional strike may still reach out to greet you. There are many reports of strikes occurring to aircraft operating between clouds or in other areas where no thunderstorms were forecast, and a few pilots have even reported "bolts from the blue." Thus, even if you fly diligently by the book, you can probably expect to be "zapped" sometime during your flying career.

WHAT EFFECTS CAN YOU EXPECT?

As we said before, electric currents of up to 200,000 amperes will flow through your aircraft between lightning entry and exit points when you are struck. Owing to its short duration, most of this current will remain in the skins, with relatively little of it diffusing into interior spars and ribs. Fortunately, aluminum is a very good electrical conductor and there is enough of it in most aircraft to conduct this current.

FIG. 5 Commercial Aircraft Lightning Strike Experience



In most cases the only noticeable effect of this current having passed through your aircraft will be small pit marks where the lightning flash momentarily attached, as shown in Figure 7. At trailing edges or other places where the flash can hang on longer, a hole might be melted. Holes can be prevented by making the skin thick enough (0.080 inches will usually suffice) but skins that thick are heavy and are usually used only over fuel tanks or other critical places where penetration of the hot arc cannot be permitted.

Lightning may do a lot more damage to nonmetallic structures such as the fiberglass radome shown in Figure 8. In this case, a streamer induced from the radar dish probably punctured the radome wall and reached the approaching leader. Then when the return stroke followed this path, its explosive blast pressure shattered the radome. The radome contained the blast until its pressure had built to a very high level, resulting in a "violent explosion," forcing the crew to eject.

If there is a pitot probe on the radome, as is the case on most fighters, the probe forms a good lightning rod. Usually the pitot probe is grounded to the airframe by a wire inside the radome. Sometimes these ground wires are too thin to carry severe lightning currents and have exploded on several occasions, with damage similar to that of Figure 8. Sometimes the aluminum tubes which bring pitot static pressure back to the instruments have acted as the ground conductor, but the intense magnetic fields surrounding lightning currents often crimp such tubes, cutting off instrument air. To make matters even worse, the cord which brings electric power out to the probe heater is also susceptible to the lightning magnetic fields. These fields may induce severe surge voltages in the heater power circuit. Since the heater is usually powered from the essential bus, other equipment powered from this source is exposed to the same surge. The immediate result has been damage to a variety of other electronic equipment, and has led, in a few cases, to loss of the entire aircraft. Figure 9 shows typical lightning damage to pitot static lines and a heater power cord. Much more is known today about how to protect against these effects, so that radomes and pitot systems in the aircraft now being built are not likely to be as vulnerable.

Because they are usually located on wing tips or other extremities, navigation lights are frequently struck. Normally, the flash attaches to the metal lamp housing and does little damage, but once in awhile it will break the globe and light bulb, as happened to the



FIG. 7
Pit marks where flash attached



FIG. 8
Radome shattered by glass effect

Typical lightning damage to pitot static lines and heater power cord

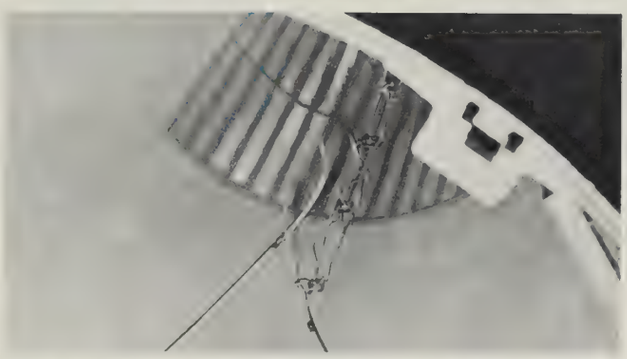




FIG. 10 NAV light globe broken by lightning, leaving a path for lightning current to enter aircraft's electric system.

LIGHTNING AND AIRCRAFT

continued

lamp in Figure 10. If this occurs, a portion of the lightning current may get into your aircraft's electric power distribution system and damage electronic equipment powered from the same bus. This, like the pitot heater situation above, is another of the more hazardous lightning effects for it may cause loss of instruments or communication equipment you rely on in bad weather. The circuit breakers for this equipment will usually pop, but not before the lightning surge has already passed through and done whatever damage it can. Surge arrestors are available to suppress these surges before they get this far, but they are not found on all aircraft. If this happens to you and some circuit breakers pop, try to reset them, but be aware that some equipment may be permanently damaged.

FUEL SYSTEMS

The vapor over a partially filled tank of JP-4 can be explosive at the flight altitudes and temperatures where lightning strikes most frequently occur, as indicated by the flammability limits of a JP-4/air mixture shown in Figure 11. The overpressure which such a mixture can produce when ignited is shown in Figure 12, and these figures show that the maximum degrees of flammability and overpressure occur near the flight altitudes and temperatures at which most lightning strikes to aircraft are reported to occur.

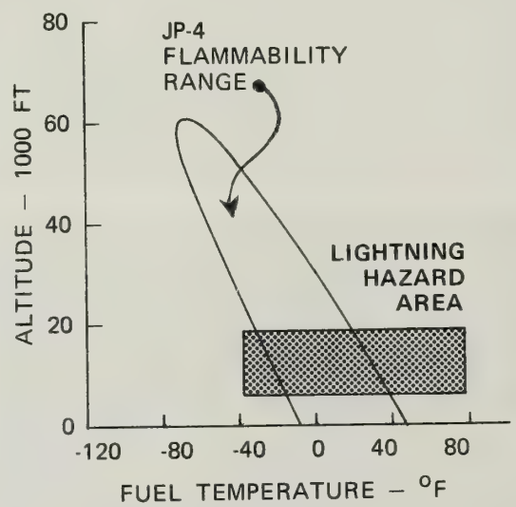


FIG. 11 JP-4 flammability range.

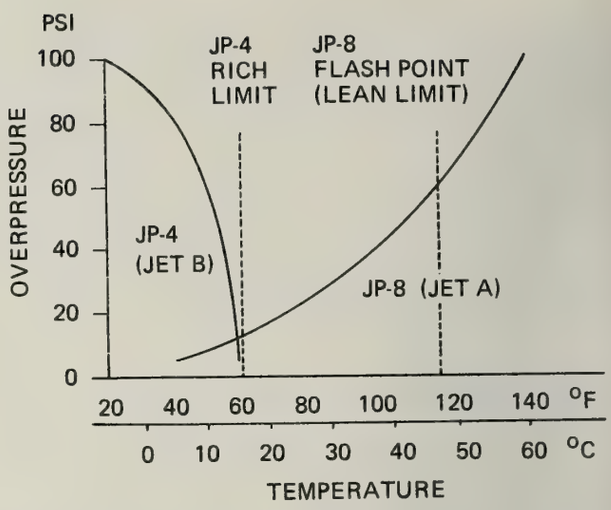


FIG. 12 Pressures generated on ignition of partially fitted fuel tanks under sloshing conditions.

There have been many laboratory studies made of the ways a lightning flash might produce a source of ignition within an aircraft fuel tank. Flashes attaching to access doors and filler caps have been found to cause sparking across inadequate joints or bonds; and flashes attaching to the surface of an integral tank skin have been shown capable of burning a hole if permitted to dwell long enough at one place or if the skin is too thin. Also, simulated lightning flashes have been shown to be capable of igniting vapors at fuel vent outlets under certain airflow conditions—conditions that almost certainly would not exist in flight. Protective measures for each of these situations have been developed, however, and incorporated into today's aircraft, so that the probability of fuel ignition from a lightning strike is remote.

Since the causes of some in-flight fuel tank explosions have never been found, there may still be lightning-related ignition mechanisms which are not fully understood. This is another reason why thunderstorm areas should be avoided, and why operations involving the fuel system, such as in-flight refueling or dumping of fuel, should be avoided while flying in conditions where lightning strikes may occur.

INDIRECT EFFECTS

The lightning effects discussed thus far are frequently termed the *direct effects* because they involve some

sort of physical damage. In recent years it has become apparent that there are other *indirect effects* produced by lightning strikes. Flight and engine instruments and other electronics have occasionally malfunctioned even though no direct connection with any part of the lightning flash existed. Because electronic systems are being increasingly depended on to perform critical functions in military and commercial aircraft, the Air Force Flight Dynamics Laboratory (AFFDL), National Aeronautics and Space Administration (NASA), and some of the manufacturers have initiated research programs to find out more about these indirect effects. Thus far, it has been learned that the electromagnetic fields which accompany lightning stroke currents may find their way inside an aircraft, where they induce transient voltages and currents in the aircraft's electrical wiring. This occurs even if the aircraft is all metallic, because there are still a lot of nonmetallic windows through which these fields may enter, and the fields themselves can be very intense. This summer, AFFDL, working in conjunction with NASA, will fly an instrumented Lear Jet aircraft near thunderclouds in Florida, in an attempt to record and measure the electrical transients which nearby lightning flashes induce on several electrical circuits in the aircraft.

These data will further our understanding of indirect effects and help validate test techniques that are presently in use to study induced voltages in aircraft in the laboratory.

WHAT ABOUT YOU?

The most hazardous effect you are likely to receive from a lightning strike to your aircraft is temporary blindness from the bright flash, if the strike occurs near the cockpit. This blindness usually (but not always) occurs at night and may persist for up to 30 seconds, during which time you may not be able to read your instruments. If you have a copilot, one of you may minimize this problem by keeping your eyes lowered when you think a lightning strike is imminent. Turning up your instrument lights may help by reducing your eye sensitivity before the flash occurs and making the instruments easier to regain afterwards. Keeping one eye closed is another technique.

Some pilots also report receiving a mild electric shock when lightning strikes occur. Since you are inside a conducting enclosure, the electric potentials of everything around you remain very nearly the same with respect to one another—even during the lightning strike—and you are not in danger of being electrocuted. The strong electric fields which can pass through the windows as the leader approaches, however, may give rise to streamers from your head or shoulders, causing a slight shock as the minute currents which feed these streamers pass through your body. Just as often though, the shock is simply your startled reaction to the loud bang accompanying the strike.

The effects on you may be much more serious, however, if you are flying in a nonmetallic airplane, such as a glider. In such a craft, the control cables may be the only electric conductors and place you in a direct path between attachment points, with fatal consequences.

PRECIPITATION STATIC

Our discussion thus far has dealt with lightning strikes. Another electrical phenomenon which may be even more annoying is precipitation static, more commonly called "P-static." When an aircraft is flying through rain, sleet, hail, or snow, the impact of these particles on the aircraft will cause a charge to separate from the particle and join the aircraft, leaving the aircraft with a preponderance of positive or negative charge (depending on the form of precipitation) and thereby elevating its potential with respect to its surroundings. Since the aircraft has room for only a small amount of this charge, some of it will begin to leak off in the form of ionization at sharp extremities. This ionization continues as long as the aircraft is flying in P-static charging conditions (precipitation) and is visible as a bluish corona (St. Elmo's fire) at night. Unfortunately, this ionization radiates broadband electromagnetic radiation (EMR) throughout the low and high frequency radio bands. This EMR is often received as interference, or "static" by the aircraft communications or low-frequency automatic direction finding (LF-ADF) or communication receivers, and may render this equipment temporarily unusable. The static dischargers usually found on tips and trailing edges reduce this interference by making it easier for the charge

LIGHTNING AND AIRCRAFT

continued

to leave the aircraft, but they are not always 100 percent effective, especially in heavy precipitation. Since the conditions that produce P-static may also produce lightning, a strike should be considered possible when P-static appears, but except for providing an easily replaceable attachment point, the static dischargers provide little protection against lightning strikes.

We have reviewed the conditions where lightning is most prevalent and discussed some of the more common things to expect when you are struck. There are new structural materials and electronic devices becoming available whose susceptibility to lightning effects is not known, and there are still aspects of lightning itself which we do not fully understand. Therefore, a considerable amount of research is under way at present to learn more about lightning and its effects, and how to design even better protection into new aircraft.

To date relatively few serious incidents or accidents can be attributed to lightning, but there are two trends in aircraft design which promise to aggravate the problem unless positive protective measures are utilized. The first of these is the increasing use of miniaturized, solid-state components in aircraft electronics and electric power control systems. These devices are more efficient, lighter in weight and far more functionally powerful than their vacuum tube or electromechanical predecessors, but they operate at much lower voltage levels and thus are inherently more sensitive to overvoltage transients such as those induced by lightning.

The other trend is toward the use of nonmetallic materials in place of aluminum in skins and structures. This reduces the amount of electromagnetic shielding which the airframe provides and increases the exposure of wiring to electromagnetic fields. Nonmetallic materials may also aggravate some of the other effects noted earlier. Streamers may be drawn from conducting objects inside plastic wing tips or radomes, for example, puncturing them on their way out to meet an oncoming leader. The stroke current may then do extensive damage to the plastic sections. Fortunately, most manufacturers recognize this problem and provide *diverter* strips to minimize punctures of plastic extremities which enclose vulnerable items such as fuel cells or electrical wiring. Together, these two trends present a challenge to the designer of lightning protection for aircraft of the future, but the challenge can be successfully met if it is recognized early in design.



FIG. 13 Simulated lightning tests on wing-tip fuel tank at the GE High Voltage Laboratory, Pittsfield, Massachusetts.

Usually, the vulnerability of new materials or devices to lightning, and the adequacy of protection systems, is determined by subjecting them to simulated lightning strikes in a laboratory. The Air Force Flight Dynamics Laboratory has recently installed a lightning simulation facility for this purpose, as have some of the aircraft manufacturers. Others utilize facilities such as the GE High Voltage Laboratory pictured in Figure 13. The GE Lab was originally built to help design lightning protection for electric power systems, but much of its equipment is applicable to aircraft testing as well.

Much is being learned in the laboratory, but our progress there is only as good as our ability to simulate the real-life environment. Thus, we continually seek reports from you who experience the real thing in flight—reports especially of incidents that seem unusual for some reason, or ones that cause a malfunction of some piece of equipment. You can help by providing complete information on these incidents to the Air Force Inspection and Safety Center. Those of most importance are the ones involving electrical or electronic equipment malfunctions. Describe the malfunction as you experienced it and try to follow up with maintenance and repair personnel to see if you can find out what exactly burned out or malfunctioned. Photographs of unusual damage will also be helpful as will retention of damaged parts for further inspection. Of course, many lightning strikes are "routine" events and need not be elaborated upon except as requested in AFR 127-4. But the extra time you take to report the unusual ones will help designers provide better lightning protection in the future. ★

LIBRARY U.S. AIR FORCE AEROSPACE SAFETY

OPS TOPICS

WIND SHEAR TEST

The FAA will begin tests early this summer of a new surface wind monitoring system (SWIMS) to detect low level wind shear caused by thunderstorms and fast moving weather fronts. The tests will be conducted at six airports: Tampa International; Oklahoma City's Will Rogers; Houston Intercontinental; Denver Stapleton; the W. B. Hartsfield Atlanta International and New York's J. F. Kennedy.

Using a mini-computer, the SWIMS will compare measurements of wind speed and direction obtained by sensors located in the runway approach corridors with wind data obtained near the airport center. When a significant difference in wind velocity—approximately 15 knots—is detected, an aural and visual alarm is triggered in the control tower cab, alerting controllers to potential wind shear conditions.

The SWIMS unit will give air traffic controllers better wind information from as many of six points on and around the airport. As a result, they will have additional time to alert pilots and possibly time to rearrange traffic flows to avoid possible wind shear situations.

ARE YOU PREPARED?

During an FCF in an RF-4C, the WSO heard a loud thump and saw sparks and smoke coming from under the aft part of the right rear console. This continued for about 15 seconds, with sparks shooting into the WSO's face and lap and burning holes in his jacket. He turned off everything in the rear cockpit except the INS and the crew went to 100 percent oxygen.

After recovery and maintenance having a look, the AC cannon plug that attaches to the AC control box was found burned through on one side. Specialists feel the cannon plug failed internally, although they don't know why.

The point for aircrews, of course, is that you must be prepared for the unexpected—like the airplane spitting sparks at you.

CHECKLIST DEVIATED?

After about 2½ hours of flight, the crew of a UH-1N heard a pop and discovered that the nr 1 engine had failed. They made an uneventful landing at their destination and started to investigate. Before takeoff from the previous landing site, the copilot placed his checklist binder on the forward left pedestal console. During the takeoff the binder slid down the console and came to rest against the nr 1 engine console. About two minutes after takeoff, the copilot lifted the binder so he could see the aux fuel switch position. The checklist binder spiral wire caught on the nr 1 engine governor switch, moving the switch from auto to manual and back. This is when the crew heard the pop and found the engine failed. The movement of the governor switch from auto to manual with the throttle above flight idle may cause an engine overspeed or overtemp and possible engine failure (as in this case).

The lesson to be learned applies to all who fly. Unsecured checklists, aircraft forms, flashlights, etc., can cause unwanted problems in aircraft cockpits and flight decks. Good housekeeping procedures are a must for aircrew members. ★

MAIL & MISC.

Send your thoughts, ideas, comments,and questions to:
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CRASH SURVIVAL

Lt Col Charles Pocock
AFISC/SE

1. In response to your article in **Aerospace Safety** (July 1976, "Escape"—Ed) concerning crash survival, I reviewed procedures currently in use on the C-9 for crash landing/ditching. As a result, I recommended some changes in the crash position described in the Dash 1. Based on this recommendation, AF Forms 847 were developed to modify both the C-9 and C-141 Dash 1s. The change to the C-9 Dash 1 has been approved. . . .

2. My rationale for requesting the change is based on the need to protect the hands and arms during a rapid deceleration. In an aft-facing seat, grasping the seat arms has three disadvantages: (1) The armrests are not secured to the seat, (2) The passenger in the center seat must share/fight for the armrests with passengers on either side, and (3) Extending the mass of the arms away from the body will create high G-loading on the arm and could easily result in flailing and injury. On the other hand, keeping the hands under the armpits protects them and concentrates the mass to minimize flailing. . . .

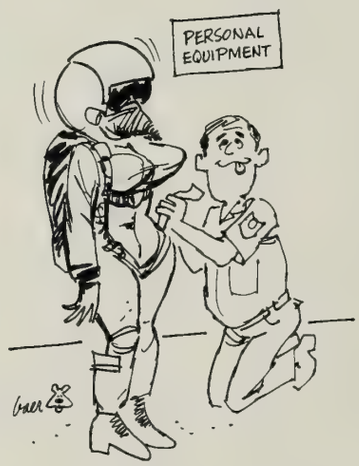
RICHARD E. SIMMONS, Capt, USAF
Flying Safety Officer
HQ 375 AAW
Scott AFB IL

Thank you for your letter. . . . On a high G impact (9 Gs), there is no question that the flailing injuries will occur if the arms are not folded across the torso. If the arms were to go up overhead, shoulder dislocation would be very possible.

The need to protect the hands and feet for successful escape is highlighted in Brig Gen William W. Spruance's (USAF Retired) presentation "Crash Survival." This presentation was recently put on 16mm film (AF #AVR 133). AAVS indicates this film is now available, however, is probably not yet listed in the film catalogue. Gen Spruance is available as a speaker and I am sure would welcome any telephone discussion on this subject. He can be reached through the Delaware National Guard. The safety office at Dover should know how to get in touch with him. Another excellent reference on this subject is Mr. Harry Robertson. Mr. Robertson is on the staff of the Crash Survival Investigator's School, Arizona State University, Tempe, AZ.

Again, thank you for your letter. If I can be of any further assistance please contact me at AUTOVON 876-2226. Unless I hear otherwise, I intend to pass this letter on to the Editor of Aerospace Safety *as an example of positive response to his publication.*

CHARLES L. POCOCK,
Lt Col, USAF
Action Officer,
Flight Safety Division
Directorate of Aerospace Safety



OLD OR UNUSUAL AIRCRAFT?

Do you have any pictures of old or unusual aircraft?

Would you share them with the readers of **Aerospace Safety?** If so, please write to the editor, **Aerospace Safety** magazine, AFISC/SEDA, Norton AFB CA 92409. We advise not to send irreplaceable or very rare photographs.

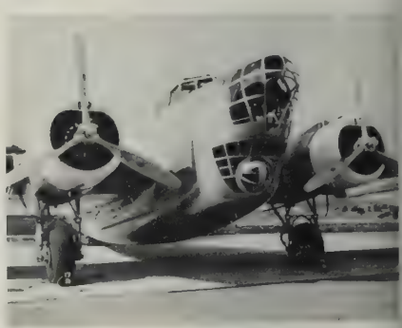
NEW BASE HOUSING OCCUPANCY RULES FOR TDY ENROUTE

Going TDY enroute to a new assignment? A new change to the housing regulation may help reduce some of the trauma. Now an Air Force member going TDY enroute is specifically allowed to have his dependents continue to occupy base housing. The only requirement is that the member must be able to return to the station after TDY to clear the family from housing. AFM 30-6, "Assignment of Family Housing", is the governing regulation. If you are living in base housing and anticipating a PCS, TDY enroute, check this out with your housing office. It may make your planning easier.

THE OTHER COMMAND

It has been brought to our attention that the biography for Major Thomas C. Skanchy, author of "Flying The Eagle" in the February 1977 **Aerospace Safety,** was unclear. Major Skanchy instructed in ATC for three years after completing pilot training.

NAME THAT PLANE



Can you name this variation of the DC-3 produced for the General Staff in the 1930's? For answer see inside front cover.



☆U.S. GOVERNMENT PRINTING OFFICE 1977 789/855/46

TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



Pictured left to right above are SSgt Beltz, MSgt Johnson, Mr. Raccasi, TSgt Scrivani, 1Lt Mole, Capt Stokes and Capt Stroup.

CAPT George N. Stokes
CAPT Robert J. Stroup
1LT Richard E. Mole
MSGT Gerald Johnson
TSGT William Scrivani
SSGT Thomas R. Beltz
MR. John Raccasi

Air Force Flight Test Center
Edwards Air Force Base, California

Captain Stokes, pilot, and crew were flying in an HH-53 helicopter for midair retrieval of a remotely piloted vehicle (RPV). The helicopter had been modified and equipped with a midair retrieval system and other special test equipment. The load line between the RPV main parachute and the engagement parachute prematurely broke the breakaway tie at the skirt of the main chute canopy and shifted its position 180° around the canopy until it was over a white aiming panel. Because the load line was white, it was not visible to the pilots during the approach. All main parachute breakaway straps and release mechanisms worked normally. However, the main parachute was draped over and became entangled with the load line. At the time, the main parachute looked like a streamer that could have re-inflated at any moment. The re-inflation of the 100-foot main parachute would be the same as a main parachute hang up, a very hazardous condition. Because of the probability of main parachute re-inflation whipping all the cable off the winch drum on the helicopter, with the added possibility of injury to crew members working near it, no winch cable was reeled in as is normally done. The RPV's jettisonable chaff pods were retained to help cushion the coming touchdown. However, with 390 feet of the RPV's load line and 100 feet of the helicopter's cable, there was insufficient power to hover at 500 feet and gently set down the RPV. Helicopter airspeed was decreased and a minimum rate of descent established. But when the firing buttons for the explosive cable cutter were depressed, the cutter jammed and the RPV was dragging on the ground. Captain Stokes increased airspeed to maintain altitude and Staff Seargeant Beltz, winch operator, reeled the cable in. Captain Stokes was able to make a max power, slow rate descent to place the RPV on the ground where it was cut free. Damage was minimal. Captain Stokes and crew exhibited outstanding ability in handling an extremely difficult and dangerous situation. WELL DONE! ★

USAF SAFETY AWARDS



CHIEF OF STAFF

INDIVIDUAL SAFETY AWARD

Presented to Air Force personnel who made exceptional contributions to safety during the previous calendar year.

MAJOR EDWARD R. MARSEY
89th Military Airlift Wing (MAC)

SSGT PATRICK J. CONROY
5071st Air Base Squadron (AAC)

SSGT JOHN P. LEIBIN, JR.
90th Security Police Group (SAC)

SSGT DAVID A. TREZISE
823rd Civil Engineering Squadron (TAC



THE KOREN KOLLIGIAN, JR., TROPHY

Awarded to the USAF aircrew member who most sucessfully coped with an in-flight emergency.

CAPTAIN ROBERT G. DOWNS
TAC



THE COLOMBIAN TROPHY

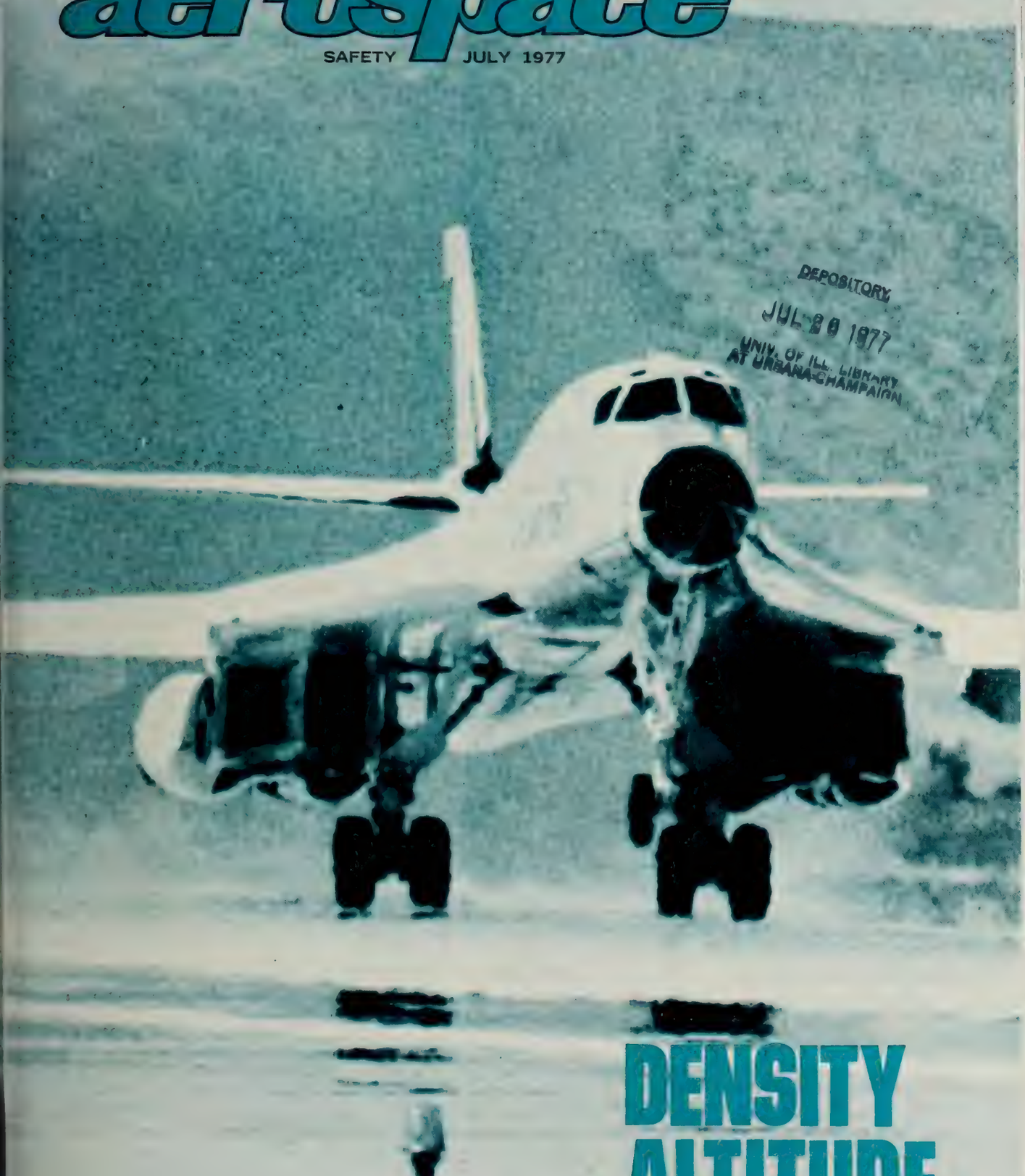
Recognizes outstanding achievement in military aviation safety by an Air Force unit involved in tactical air operations.

36TH TACTICAL FIGHTER WING
USAFE

29.1305
FLYS

aerospace

SAFETY JULY 1977



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JULY 1977

UNITED STATES AIR FORCE

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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The Inspector General, USAF

MAJ GEN RANALD T. ADAMS, JR
Commander, Air Force Inspection and Safety Center

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SPECIAL FEATURES

FLYING WITH MARY JANE
PROFESSIONALS DON'T ASSUME
YOU AND THE D.A.
HOW STABLE IS YOUR F/RF-4?
MAINTAIN YOUR PRESENT ALTITUDE
YOUR PROBLEM, TOO
TAXI ANYONE? WHAT PRICE CARELESSNESS?
THE FUEL FLOW GAGE
GENERAL AVIATION . . . FLY SMARTER

REGULAR FEATURES

NEWS FOR CREWS 1
THERE IS A WAY 6
THE IFC APPROACH 10
OPS TOPICS
MAIL & MISC.
WELL DONE AWARD

NAME THAT PLANE

BOEING B-9

The B-9 introduced new aerodynamic concepts as a low wing all metal monoplane. The real departure was in the design of the B-9 specifically for strategic bombing rather than as a multi-purpose aircraft as the earlier bombers had been. Although the B-9 still had open cockpits, the new design features marked the first real steps toward the great bombers of World War II.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, US

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JULY 1977 AFRP 127-2 VOLUME 33 NUMBE

NEWS FOR CREWS

CAPT RICHARD D. MARTIN, AFMPC

Rated Special Duty Assignments

AFR 36-20 (THE OFFICER ASSIGNMENTS REGULATION) OUTLINES IN CHAPTER 8 A CATEGORY OF ASSIGNMENTS KNOWN AS "SPECIAL DUTY ASSIGNMENTS (SDAS)." THE DUTIES INVOLVED PROVIDE UNIQUE AND CHALLENGING OPPORTUNITIES TO CAPABLE OFFICERS WITH STRONG PERFORMANCE RECORDS. MOST RATED OFFICERS ARE FAMILIAR WITH A NUMBER OF THESE ASSIGNMENTS, BUT ARE OFTEN UNCERTAIN OF FULL ELIGIBILITY CRITERIA AND APPLICATION PROCEDURES. ADDITIONALLY, WE FIND THAT SOME OFFICERS ARE RELUCTANT TO APPLY, BELIEVING THE CHANCES OF SELECTION ARE SLIM. OFTEN THE OPPOSITE MAY BE TRUE, IN THAT ADDITIONAL QUALIFIED VOLUNTEERS ARE NEEDED.

ALTHOUGH CHAPTER 8 COVERS BOTH SUPPORT AND RATED SPECIAL DUTY ASSIGNMENTS, IN THIS ISSUE WE WILL REVIEW ONLY RATED SDAS. IF AFTER THE BRIEF REMINDER OF SDAS PROVIDED HERE YOU BELIEVE YOU WOULD ENJOY PERFORMING DUTY IN A SDA, WE URGE YOU TO CONSULT AFR 36-20 FOR FULL DETAILS AND FOLLOW UP WITH AN APPLICATION. SPECIFIC RATED SDAS FOLLOW.

Air National Guard and USAF Reserve Program Advisors

REQUIRES SENIOR CAPTAINS THROUGH FIELD GRADE PILOTS AND NAVIGATORS WITH STRONG RECENT EXPERIENCE IN RESERVE COMPONENT AIRCRAFT.

US Military Groups (USMILGP) Latin America

PRIMARY REQUIREMENTS ARE FOR OFFICERS QUALIFIED IN TACTICAL FIGHTER SYSTEMS. REQUIRES LANGUAGE ABILITY IN MOST INSTANCES ALONG WITH ABILITY TO FUNCTION IN QUASI-DIPLOMATIC ENVIRONMENT.

UPT/UNT Instructors (ATC)

REQUIRES MOTIVATED JUNIOR OFFICERS WITH STRONG MILITARY RECORDS AND SOLID FLYING CREDENTIALS IN OPERATIONAL AIRCRAFT.

Civil Air Patrol—USAF

OFFERS WIDE GEOGRAPHIC OPTIONS AND REQUIRES RATED OFFICERS WITH SOLID RATED RECORDS AND DEMONSTRATED POTENTIAL TO FUNCTION WITH STATE AND FEDERAL GOVERNMENT OFFICIALS.

SAC U-2 Program

REQUIRES HIGHLY QUALIFIED PILOTS WITH AT LEAST 1500 HOURS TOTAL, 1000 HOURS JET, FLYING TIME IN TWO OR MORE AIRCRAFT. ADDITIONAL APPLICANTS PARTICULARLY NEEDED AT THIS TIME.

SAC SR-71 Program

REQUIRES HIGHLY QUALIFIED PILOTS AND NAVS FOR DEMANDING STRATEGIC RECONNAISSANCE MISSIONS. ADDITIONAL RECONNAISSANCE SYSTEM OPERATOR (RSO) APPLICANTS ARE PARTICULARLY NEEDED AT THIS TIME.

Officer Exchange Program

REQUIRES RATED OFFICERS WITH OUTSTANDING PERFORMANCE RECORDS ABLE TO REPRESENT THE USAF WITH ALLIED AND SISTER SERVICES.

89 Military Airlift Wing (MAC)

REQUIRES PILOTS AND NAVS OF THE HIGHEST PROFESSIONAL COMPETENCE TO PROVIDE WORLDWIDE AIRLIFT TO HIGH RANKING OFFICERS OF OUR GOVERNMENT PILOTS MUST HAVE A MINIMUM 3000 FLYING HOURS AND NAVS A MINIMUM OF 2000 TOTAL.

USAF Thunderbirds

DUTY WITH THE USAF AERIAL DEMONSTRATION TEAM REQUIRES PILOTS OF THE HIGHEST COMPETENCE, PRIMARILY WITH EXTENSIVE FIGHTER EXPERIENCE, TO REPRESENT THE USAF WORLDWIDE. ★

FLYING WITH





Hundreds of thousands of peo
ple—young and old alike—
are physically dependen
upon drugs—diabetics on insulin
angina victims on nitroglycerin
epileptics on anticonvulsants and
high blood pressure victims on di
uretics. But their dependency on
such drugs is necessary for them
to lead a normal, healthy life.

In contrast to these people
there are thousands of others who
are dependent on a broad spec
trum of drugs which affect them
physically and psychologically
These are legal social drugs such
as alcohol, tobacco and caffeine
over-the-counter drugs; legall
prescribed drugs such as amphet
amines, barbiturates and tranqui
izers; and illegal "hard" drugs
Somewhere near the middle of thi
drug spectrum is marijuana (a
fectionately known by users a
pot, tea, grass, weed, or Mar
Jane), a growing concern in ou
society and a potential threat t
aviation safety.

When smoked, marijuana quick
ly enters the bloodstream an
within a few seconds (minutes a
the most) begins to affect th
user's mood and thinking for tw
to four hours.

The psychological effects on th
emotions and senses vary widel
depending on what the user e

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MARIJUANA

LT COL DAVID H. KARNEY, M.D.
Medical Division
US Army Agency for Aviation Safety

pects from the drug, the circumstances under which it is used, and the strength and quantity of the drug. Time is distorted and five minutes may seem like an hour. Space may seem enlarged or otherwise distorted, and sound and colors sometimes seem intensified. Thought frequently becomes dream like, and some individuals believe they are thinking better than usual. Recent evidence shows that there is a loss of immediate recall and that it is difficult to think or speak due to disorganization of recent memory.

JUDGMENT AFFECTED

Like alcohol, marijuana affects judgment, and an individual may find it much harder to make decisions which require logical thinking. At the same time, he may erroneously believe that his judgment is unimpaired, or even that his mental functioning has been enhanced by the drug. The performance of any complex task which requires good reflexes and clear thinking is impaired, making such tasks as driving or flying particularly dangerous.

Marijuana, like all intoxicating drugs including alcohol, has no place in our aviation environment. While few aviation accidents have been reported in which marijuana usage by maintenance personnel or aircrewmembers was a factor, it is a well-known fact that use of the drug is widespread among servicemen and it would be naive to think the aviation population has not been affected. The absence of documented marijuana-caused accidents is grossly misleading since proof of intoxication is, for all practical purposes, impossible at the present time.

However, there is information available concerning the effects of marijuana on an aviator's flight ability. An informal inquiry conducted by the University of California revealed that social marijuana smoking is not an uncommon practice among civilian-type aviators, some of whom reported that they had even flown while "high" on marijuana. For this reason, the University conducted an experiment to determine the effects of the drug on the aviator's ability to operate aircraft.

The test was conducted in instrument flight simulators using seven professional and three private pilots who had smoked marijuana socially for several years. Before actual testing, the aviators were familiarized with four consecutive 4-minute holding patterns, which included maneuvers encountered in instrument flight; straight and level flight; turns; pitch, roll, and yaw maneuvers; radio navigation, etc. These tasks required coordination as well as short term memory, concentration, and orientation in time and space. Two flights consisted of a standard holding pattern and two of a modified holding pattern requiring altitude changes. Also, mild turbulence was added so that aviators would be required to continually manipulate the controls to maintain the desired attitude. These flight profiles were carefully chosen to demand a high level of flying skill to correctly complete the sequence.

FLYING SKILL DEGRADED

Once the pilots were proficient in operating the simulator and in performing the holding patterns, two tests were conducted one week apart. Unknown to the pilots they were separated into two groups with each group serving as its own control in two separate tests to validate the results. Before the first test, one group smoked a placebo (containing no active drug). For the second test, the pattern was reversed. Flying performance of the pilots was then

FLYING WITH "MARY JANE"

TABLE 1—Average Performance of 10 Pilots 30 Minutes After Smoking Marijuana or Placebo (Values Indicate Total Deviation From Assigned Flight Path During Entire 16-Minute Flight Sequence for Pilot Group).

	ACTIVE	PLACEBO
PULSE	107	73
HIGH RATING	10.5	0.5
ALTITUDE (METERS)	797	207
HEADING (DEGREES)	627	332
RADIO NAVIGATION (CDI UNITS)	100	42
MAJOR ERRORS	2.9	0.4
MINOR ERRORS	4.5	0.7

Marijuana, like all intoxicating drugs including alcohol, has no place in our aviation environment.



evaluated. In contrast to the placebo, marijuana caused a gross decrement in flying performance with increased prevalence of major and minor errors, altitude and heading deviations, and radio navigation errors. (See table 1.) The effects of the drug persisted for at least 2 hours, generally disappearing within 4 to 6 hours after it was administered.

Several major problems were noted in flying the simulator while under the influence of marijuana —the most significant being its effect on short-term memory and time sense. Aviators often forgot where they were in a given flight sequence or had difficulty recounting how long they had been performing a given maneuver in spite of the presence of written instructions and a stopwatch. Marijuana also appeared to cause alterations in concentration and attention, so that pilots would become preoccupied with one task. As an example, several pilots noted that, following concentration on one particular flying task, they could not tell how long they had been flying or where they were located in the flight sequence. Once they realized this, they would then overcontrol the aircraft in correcting for errors in tasks which they previously had ignored. At times they exhibited a complete loss of orientation with respect to the navigational fix. This loss of orientation occurred when the pilots were either daydreaming, lapsing, or focusing on one certain part of their specified routine.

Although the results noted were quite dramatic in the flight simu-

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lator, it is believed that pilot performance in actual flight situations would be even more adversely affected by marijuana. The pilots tested performed a memorized flight sequence and had the instructions for the pattern in front of them at all times. In actual flight situations, instructions come sequentially from an air traffic control specialist and must be accurately noted and repeated (i.e., read back) by the pilot.

Unfortunately, there has been little research into the effects of marijuana intoxication on personnel performing specific jobs such as aircraft maintenance, air traffic control, or other support duties. However, the effects of marijuana upon human performance, particularly those tasks requiring a high level of skill, memory, interpretation, awareness, and judgment, have been well documented. Based on this research and on the detrimental effects of marijuana intoxication on the performance of aviators, it is logical to assume that job performance of all aviation-related personnel would be affected.

MARIJUANA VS ALCOHOL

There is much controversy about the use of marijuana versus the use of alcohol. Note the following opposing statements comparing marijuana and alcohol intoxication.

"Marijuana perhaps more than any other drug is the NOW generation. Not just the hippies or the dropouts or the alienated but the doctors, lawyers, and all kinds of chiefs of tomorrow say marijuana is it. It is better than booze—no hangover. It is a mind drug, not a body drug, while alcohol and nicotine are known to be responsible directly or indirectly for much illness and many deaths. It is a euphoriant in a world that needs joy, not the obliteration of sensation that accompanies alcohol. It is not addicting, whereas hard liquor is. No one dies when they stop using it; some have died when they stopped drinking. It represents and is part of a new attitude toward life while alcohol is regressive."

On the other hand . . .

"Nonsense. Marijuana smoking is frequently the first step toward dropping out of life. It sometimes leads to the use of even more dangerous drugs. It has not been studied enough to say it is harmless. It is a symbol of attitude that will destroy our country and lower everyone's standard of living. Alcohol does present problems but it is the drug of choice in all of the more technologically advanced countries, so it cannot be too bad. Marijuana, on the other hand, is used only in the backwater countries of the world."

Regardless of the pros and cons, we know that alcohol is a dangerous drug physically, psychologically or socially for millions of people whose drinking is out of control, that it is a factor in one-half of all highway accidents, and that it has also been a factor in numerous aircraft accidents. And, based on the limited research presently available, there is no firm evidence that "pot" would be less harmful if used as consistently as alcohol.

Although marijuana is not a narcotic and does not appear to cause physical dependence such as heroin or other hard narcotics, users of marijuana are more frequent abusers of other stronger drugs. This may be sociological, but the relationship does exist.

PENALTIES SEVERE

The use of marijuana is illegal and the penalties for possession are severe. According to the federal legal controls based on the Controlled Substance Act of 1970, unlawful possession is punishable by up to one year imprisonment and/or fines of up to $5,000. A second offense can be punishable by up to twice the imprisonment and fines of the first offense.

Unlawful distribution of marijuana, or possession with intent to distribute, is punishable by up to 5-year imprisonment and/or fines of up to $15,000 plus 2 years of required special parole. A second offense can be punishable by imprisonment or fines up to twice that of the first offense. State laws vary as to the punishment.

Today, the effects of marijuana upon human performance is an area of major concern. No place is this concern more critical than in complex man-machine systems, such as those found in aviation, where even the slightest degradation in either flying or maintenance performance can result in catastrophic losses.

—Courtesy March 1977 US Army Aviation Digest ★

THERE IS A WAY

Annually the Air Force recognizes a given number of individuals, units and commands for outstanding performance. However, competition is keen and not all win major awards. To recognize all of those, AEROSPACE SAFETY is featuring one or more in each edition. In this way we can all share in recognizing their fine performance and, perhaps, learn some valuable lessons.

Nominated for the Columbian Trophy

318th Fighter Interceptor Sq, ADCOM

More than 8,000 flying hours in 1976, five consecutive years of accident-free flying for which they received the USAF Flight Safety Certificate. This is the record the 318th FIS has established. At the end of 1976 the 318th had flown 43,000 hours without an accident. They went without a single incident attributable to aircrew error during 1976.

A major effort of the 318th, for several years, has been to assist in the development of the Airborne Warning and Control System. Almost 400 sorties were scheduled for 1976. In addition, the squadron conducted four major deployments and participated in 16 exercises directed by higher headquarters while maintaining full alert posture.

To create a safer operation environment, an exchange program was devised whereby newly assigned weapons controllers are brought into the squadron for briefing on every aspect of the fighter mission from the pilots' perspective and given the opportunity to observe the entire fighter operation first hand. Fighter crews are given the opportunity to observe an entire intercept training mission while at the controller's position. The better understanding by both parties contributes to a safer operation.

The accident-free year of 1976 enabled the 318th FIS to extend its record to 65 months without an accident, a significant contribution to Air Force mission capability.

Nominated for the Koren Kolligian, Jr., Trophy

Captain David W. Becker

75 MAS, TRAVIS AFB, CA

Sunday, 19 September 1976: Captain Becker, the IP, and his crew were scheduled for a local C-5 training flight. During departure Captain Becker simulated a bird strike on nr 1 engine and retarded the throttle. The student pilot made a three-engine approach, a missed approach and entered the radar pattern for a precision approach. Immediately after the aircraft turned base, a "Bleed Duct Hot" light illuminated. Seconds later Captain Becker noted an overheat warning on nr 2 engine, terminated the simulated emergency, restored power on nr 1 and retarded nr 2 to idle. The overheat warning continued. Fifteen seconds later, a fire was indicated in the left inboard wing and pylon.

Faced with multiple emergencies, Captain Becker directed shutdown of nr 2 and called for the emergency checklist. A scan of nr 2 engine and the left wing indicated smoke coming from the nr 2 engine area. The IP declared an emergency and directed a turn to final. With the fire light still on, the engineer continued to discharge fire suppressant into the hot area. Then two thrust reverser lights illuminated. Captain Becker attributed these to fire damage to electrical components.

For a few seconds there was no smoke, then the scanner reported flames coming from the nr 2 pylon and left wing. With the situation deteriorating, Captain Becker directed an immediate landing on the nearest runway. On short final the nr 1 engine and left outboard fire warning lights came on. Captain Becker took control and made the landing. After the brakes were set and the remaining fire handles pulled, the crew evacuated and turned the problem over to the fire department. Total length of time for the emergency: 5 minutes. ★

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Professionals Don't Assume

MAJOR PAUL TILEY
Directorate of
Aerospace Safety

Look around your squadron. Who are the professionals? What makes them that way? The chances are that they know their jobs and they always seem to be knowledgeable about other people's jobs. That means they don't take things for granted. The professionals go out of their way to find out more than the bare minimum. The professionals don't assume, they know.

What can happen to you when you start assuming that other people are doing your job for you? Here are two examples of what can happen when you stop being professional and assume.

• Two young pilots who had just recently graduated from pilot training were flying a T-38 for proficiency. The flight had gone well and after clearing the runway, the aircrew stopped to perform their after-landing checks. As they were almost finished with their checks, the T-38 started to roll. Each pilot ASSUMED that the other had finished his checks and was taxiing the aircraft. The aircraft ran off the taxiway without causing any significant damage.

• The check ride had not gone according to plan. The flight was delayed taking off due to thunderstorms and gusty surface winds.

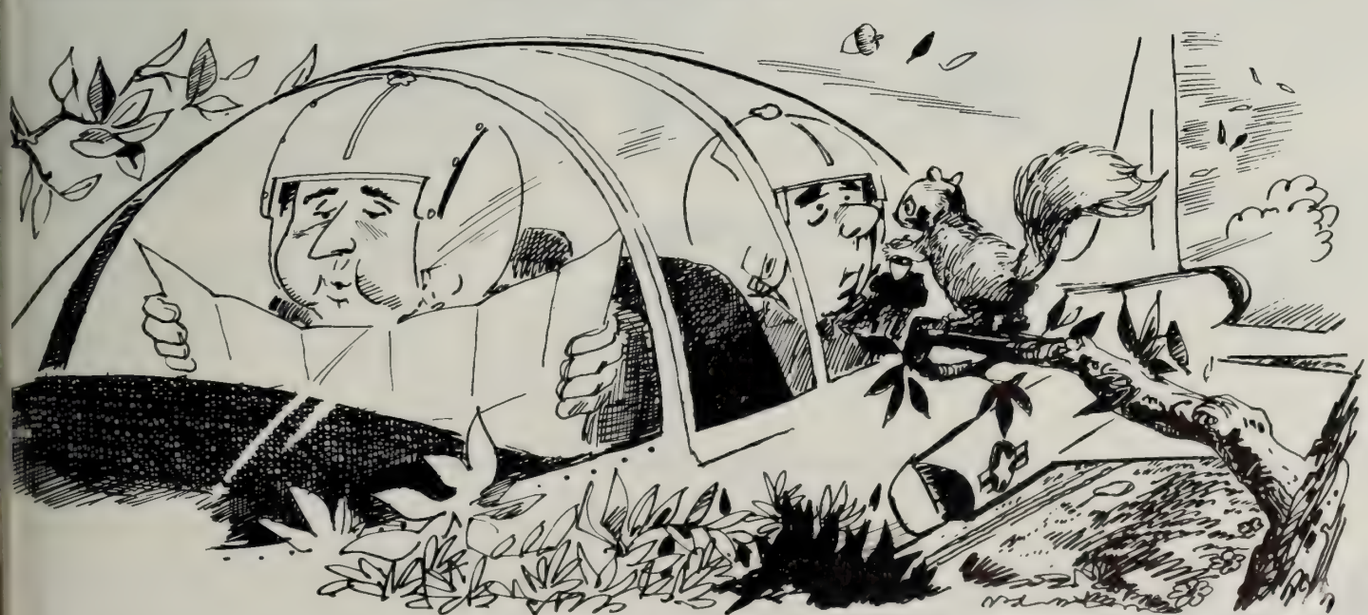
Finally airborne, the two ships proceeded to the range, which, it turned out, was closed due to weather. Proceeding back to home base, the flight contacted approach control which gave them home base weather. The gusty surface winds were out of crosswind limits, but the flight had miscalculated them as being within limits.

The wingman "assumed" that, since the flight lead did not say anything about the winds, everything was OK. The flight lead "assumed" that the Supervisor of Flying (SOF) was monitoring the weather and would advise the flight if anything was wrong.

To complete part of the check, the flight lead requested multiple approaches stating that the flight was a stan/eval check. The approach controller did not understand the request and denied the multiple approaches, "assuming" that if it was important the flight lead would repeat the request. The flight lead "assumed" the controller had some reason for not approving the request but did not question it. The flight split up and the wingman landed and experienced some directional control problems that he "assumed" was hydroplaning on the wet runway, but did not advise anyone. The flight lead didn't pay any attention to the winds that GCA was giving him, still "assuming" that the SOF would advise him if the winds were out of limits.

Lead landed and the aircraft started to drift to the edge of the runway, but the leader failed to apply proper controls and the aircraft departed the runway, causing major damage.

Flying is a complex job. More than ever the old adage, "if you don't know or understand, ask!", applies. Questioning when you aren't sure is far less embarrassing than answering questions after a mishap. ★



YOU AND THE D.A.

MAJOR PHILIP M. McATEE
Directorate of
Aerospace Safety



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It's that time of year again when your normally frisky "air machine" can start acting like it needs a trip to a health spa. It seems to act as if some gremlin had decreased its wingspan and detuned its engine(s). Takeoffs seem like your bird has an affair going with the runway, and then it climbs like the proverbial lead brick.

There is probably nothing wrong with your aircraft, the "gremlins" are most likely caused by an increase in *density altitude.*

We all know that as altitude increases, atmospheric pressure decreases. So we know, for example, that the takeoff roll from a high elevation field will be longer than from a sea level field. The reason for this is that the air is thinner (we all know that!), and as it becomes thinner it loses much of its load lifting ability. This thickness or thinness of the air may be thought of as density altitude. But is the air always the same density at the same altitude? Absolutely not! It changes constantly. To review why, let's see what density altitude really is, and then why it changes.

Density altitude is nothing more than *the altitude which the density of the air represents, regardless of the true elevation above sea level.* If the density (mass per unit volume) of the air was measured at a sea level airport one hot afternoon and found to be the same as an elevation of 5,000 ft, then the density altitude is 5,000 ft even though the actual elevation is sea level. Density altitude is affected by atmospheric pressure and temperature. In order for us to be able to measure those two factors, we need a standard. The standard atmospheric pressure at sea level is 29.92 inches of mercury and standard temperature at sea level is 15°C(59°F).

In other words, density altitude and actual elevation are the same only when barometric pressure (corrected to sea level) is 29.92" Hg and temperature is standard for the elevation (15°C or 59°F at sea level). We know these conditions are by far the exception instead of the rule. So you can see by using *actual* field elevation for calculating aircraft performance, we can be off considerably and that can get hairy. Not only will a higher density altitude give you less lift but it also reduces your engine thrust. To demonstrate the effect let's look at some examples from some typical aircraft performance charts.

As you can see, the effect of only a 50 ft increase in pressure altitude and 15°C increase in ambient temperature give a sea level field a density altitude of 2,200 feet and significantly decreased performance. *For each 9°C of temperature increase, density altitude will increase by approximately 1,000 ft and bring a corresponding decrease in performance.*

Remember these performance losses are the result of *both* the thinner air having less lifting ability plus a decrease in available engine thrust.

For an example of the decrease in engine thrust let's look at the T-38: For each 5.5°C rise in temperature above standard (15°C at sea level), there is a 4-5 percent decrease in available thrust. There is also a 2-3 percent loss of thrust for each 1,000 ft pressure altitude increase above sea level.

Thanks to the writers of your Dash 1, all that is necessary to work any of these performance calculations is to know *pressure altitude* (available from your forecaster or by setting altimeter on ground to 29.92" Hg) and ambient *temperature.* The performance charts take it from there and compute density altitude or density ratio and the effect on performance. (If you want to know the density altitude, you can easily get it from your flight computer—P.A. opposite O.A.T. read D.A.).

The point is that every takeoff will be different because of many factors. A good pilot will calculate very closely what performance he can expect, and will be especially cautious when takeoff is from a high elevation and/or air temperature is well above standard. Those kinds of surprises he can live without! ★

C-141A: Wt 300,000 lbs. - No Wind - Dry Runway
Actual Elevation: Sea Level

P. A.	= S. L.	P. A.	= 500′
O. A. T.	= 15°C (59°F)	O. A. T.	= 30°C (86°F)
Density Alt.	= S. L.	Density Alt.	= 2200′
T. O. Gnd Run	= 4300′	T. O. Gnd. Run	= 5200′
Crit. Fld Length	= 5300′	Crit. Fld Length	= 6300′

F-106A: Full Int. Fuel - No Wind - Dry Runway
Actual Elevation: Sea Level

P. A.	= S. L.	P. A.	= 500′
O. A. T.	= 15°C (59°F)	O. A. T.	= 30°C (86°F)
Density Alt.	= S. L.	Density Alt.	= 2200′
T. O. Gnd. Run	= 5600′	T. O. Gnd Run	= 6700′
To Clear 50′ obs.	= 7000′	To Clear 50′ obs.	= 8900′

THE IFC APPROACH

PARTIAL PANEL FLIGHT

Aircraft throughout the Air Force inventory are continuing to experience failures in their primary attitude indicator systems. Between January 1975 and August 1976, there were 77 attitude indicator failures reported to the Air Force Inspection and Safety Center; the T-38, F-4, A-7, F-111, and B-52 accounted for more than 50 of those reported failures. If you encounter an attitude indicator failure while in instrument conditions, you could find yourself in an emergency situation without a plan and very little time to consider the alternatives. This article is devoted to helping you formulate your "plan."

UNUSUAL ATTITUDE RECOVERIES WITH A MALFUNCTIONING ATTITUDE INDICATOR

Failure to recognize an attitude indicator malfunction often leads to an unusual attitude recovery using partial panel procedures. Successful recovery from an unusual attitude situation with a malfunctioning attitude indicator depends upon the early recognition and confirmation of the attitude indicator failure and timely application of the correct recovery procedures. Let's look at the unusual attitude "Recognize, Confirm, and Recover" steps:

Recognize that a discrepancy exists between the attitude indicator and the other instruments. Attitude indicator failure should be immediately suspected if you apply control pressures and you do not get the corresponding change on the attitude indicator, or if the performance instruments contradict what you see on the attitude indicator.

Confirm that the unusual attitude exists by cross-checking the other instruments. If a standby attitude indicator is available, check it; in multi-place aircraft, check your copilot's attitude indicator. The turn needle is also an excellent instrument to use to confirm your attitude or to use as the "tie breaker" between two conflicting attitude indicators. Cross-check the performance instruments to confirm the unusual attitude and to determine whether the aircraft is climbing or diving. Depending on your particular aircraft, you may have some other aids available to bring in to the cross-check such as, the radar horizon, heads-up display, gunsight, etc.

Recover from the unusual attitude using the following recommended techniques, unless your flight manual dictates otherwise:

FIXED WING AIRCRAFT:

If diving, level the wings by rolling away from the turn needle, to center it, and recover from the dive with adequate back pressure. Adjust the power or drag devices as appropriate.

If climbing, use power as required. If the airspeed is low, or decreasing rapidly, add power and bank using approximately a standard rate turn on the turn needle until reaching level flight (banking the aircraft will aid pitch control). Care must be taken not to use full needle deflection because overbanking could result in an undetectable, inverted position. If the small turn needle on a flight director system is used, center the turn needle during the recovery instead of using the standard rate turn; this is because on the small turn needle, it is very difficult to distinguish between a standard rate turn and full needle deflection.

When reaching level flight during the recovery (when the altimeter reverses direction), center the turn needle and slowly adjust the control pressures until the altimeter stops. Don't forget that the lagging vertical velocity indicator (VVI) may not indicate level flight at the same time as the altimeter movement. When the VVI has stabilized, try to keep it at zero. It is important to trim the aircraft for an airspeed when level; without trim, you cannot tell if the desired pitch attitude is being maintained.

ROTARY WING AIRCRAFT (HELICOPTERS):

If diving, eliminate any bank—check that the turn needle is centered, and if not, center it by rolling away from the turn needle. Recover to level flight by using aft cyclic and adjusting the collective (power) to a known power setting. Level flight is best determined by reversal of the altimeter indication.

If climbing, maintain positive G loading on the aircraft by adjusting the collective (power) to a known power setting and banking the aircraft by reference to the turn needle; however, ensure that the turn needle is not fully deflected. Return to level flight using cyclic control (watching for the reversal of the altimeter). Once established in level flight, eliminate the bank by centering the turn needle, and return to the desired flight parameters by adjusting collective and cyclic inputs as required.

WHAT TO DO NEXT . . .

Tell someone! If you encounter complete attitude indicator failure in instrument conditions, you are definitely in an emergency situation; don't delay declaring an emergency and telling the controlling agency the nature of your problem so that they can provide any possible assistance.

Get VFR if possible; this will minimize your problems. Your weather briefing should provide some clues as to whether to climb or descend to get VFR and the lo-

By the USAF Instrument Flight Center
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cation of the nearest VFR field. If you are able to get VFR, but realize that you must penetrate the weather during your descent, consider requesting assistance from another aircraft to lead you through the weather. If you cannot get VFR, and there is no one to lead you through the weather, you still have a number of options:

Use Alternate Systems. Consider "covering" the malfunctioning attitude indicator to keep it out of your cross-check. If a standby attitude indicator is available, practice the "new cross-check" long enough prior to the approach, so that it becomes comfortable. If a standby attitude indicator is not available, things are tougher, but not impossible . . .

For Pitch Control, cross-check the altimeter and VVI. Use standard power settings for specific airspeeds, keep the aircraft trimmed, and use the autopilot if available.

For Bank Control, use the turn needle and cross-check the heading indicator for any movement which would indicate a bank.

Pick a penetration and approach that will minimize the pitch and bank inputs. Approaches with holding patterns, arcs, and penetrations with high descent rates should be avoided if possible since they are difficult to fly with a malfunctioning attitude indicator and the chance of getting into an unusual attitude is increased. Radar vectors with a shallow enroute descent will provide a good recovery to limit the pitch and bank inputs. Start the descent far enough out so that the descent gradient will be shallow. Use a descent rate that is comfortable, remembering that a high rate of descent makes the level-off more difficult.

When you begin the enroute descent, slowly lower the nose until the VVI reads the desired value and trim the aircraft for that vertical velocity. Maintaining this rate during the descent will allow you to control your descent gradient. Lead the level off by more than the normal 10% of the vertical velocity to allow for the slower level-off made by referencing the VVI and the altimeter.

What type of final approach should you plan to fly once you've

INSTRUMENT APPROACH PROCEDURE CHARTS
RATE OF DESCENT TABLE
(ft. per min.)

A rate of descent table is provided for use in planning and executing precision descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, attitude combination can be programmed which will result in a stable glide rate and attitude favorable for executing a landing if minimums exist upon breakout. Care should always be exercised so that the minimum descent altitude and missed approach point are not exceeded.

ANGLE OF DESCENT (degrees and tenths)	GROUND SPEED (knots)										
	30	45	60	75	90	105	120	135	150	165	180
2.0	105	160	210	265	320	370	425	475	530	585	635
2.5	130	200	265	330	395	465	530	595	665	730	795
3.0	160	240	320	395	480	555	635	715	795	875	955
3.5	185	280	370	465	555	650	740	835	925	1020	1110
4.0	210	315	425	530	635	740	845	955	1060	1165	1270
4.5	240	355	475	595	715	835	955	1075	1190	1310	1430
5.0	265	395	530	660	795	925	1060	1190	1325	1455	1590
5.5	290	435	580	730	875	1020	1165	1310	1455	1600	1745
6.0	315	475	635	795	955	1110	1270	1430	1590	1745	1905
6.5	345	515	690	860	1030	1205	1375	1550	1720	1890	2065
7.0	370	555	740	925	1110	1295	1480	1665	1850	2035	2220
7.5	395	595	795	990	1190	1390	1585	1785	1985	2180	2380
8.0	425	635	845	1055	1270	1480	1690	1905	2115	2325	2540
8.5	450	675	900	1120	1345	1570	1795	2020	2245	2470	2695
9.0	475	715	950	1190	1425	1665	1900	2140	2375	2615	2855
9.5	500	750	1005	1255	1505	1755	2005	2255	2510	2760	3010
10.0	530	790	1055	1320	1585	1845	2110	2375	2640	2900	3165
10.5	555	830	1105	1385	1660	1940	2215	2490	2770	3045	3320
11.0	580	870	1160	1450	1740	2030	2320	2610	2900	3190	3480
11.5	605	910	1210	1515	1820	2120	2425	2725	3030	3335	3635
12.0	630	945	1260	1575	1890	2205	2520	2835	3150	3465	3780

FIG. 1

IFC cont'd

descended? If the weather permits, you will probably find that non-precision approaches (TACAN, VOR, ASR, etc.) will be the easiest (and the safest) to fly since they do not require the precise pitch control necessary to stay on a precision glide path. If you think you could do better on a precision approach, try it in your simulator — you'll probably be surprised.

Prior to the final approach fix (FAF), determine the vertical velocity required for a descent from the FAF altitude to the minimum descent altitude (MDA) prior to the missed approach point (MAP). This will allow you to have the time to get the aircraft trimmed for level flight, so you can look for the runway. Non-precision approaches are normally designed to have a maximum descent gradient of 4 degrees (from the FAF to the runway); therefore, if you use a vertical velocity that approximates a 5 degree descent gradient, you will be able to level off at the MDA prior to the MAP. Having some "hip-pocket" descent vertical velocity figures should be part of your "partial panel plan." The rate of descent table (Figure 1), in the front of each instrument approach procedure book, will give you the vertical velocity for a known or approximate ground speed. For example: The vertical velocity for a 5 degree descent at 165 kts ground speed is 1455 fpm.

At the FAF, slowly lower the nose until the VVI reads the desired value and trim the aircraft to maintain this vertical velocity. Make small adjustments on the VVI during the descent to remain on the desired descent gradient. When you approach the MDA, lead the level off by more than the normal amount and slowly decrease the nose down and the altimeter is steady. Adjust the power to maintain the final approach airspeed and trim for that airspeed. Keeping the aircraft trimmed is an important factor as you prepare to make the transition from the instruments to the outside references. If there are others in the cockpit, use them to help you; an additional set of eyeballs monitoring the gauges during the approach might help you keep out of the dirt, rocks, and trees.

No matter what type of approach you choose or what techniques you use to get your partial panel aircraft back safely on the ground, forming a "plan" and practicing ahead of time *is the only way to fly.*

VISUAL DESCENT POINT (VDP)

A new concept named "visual descent point" (VDP) is being incorporated in selected non-precision approach procedures. The VDP is a defined point on the final approach course of a non-precision straight-in approach procedure from which a normal descent from the MDA to the runway may be commenced, provided visual reference with the runway is established. The VDP will normally be identified by DME on TACAN, VOR, and LOC procedures and by a 75MHZ marker on NDB procedures and other procedures where DME cannot be implemented. VDPs are not a mandatory part of the procedure, but are intended to provide additional guidance where they are implemented. A VASI lighting system will normally be available where VDPs are established. Where VASI is installed, the VDP and VASI glide paths will normally be coincidental.

No special technique is required to fly a procedure with a VDP. However, in order to be assured of the proper obstacle clearance, the pilot should not descend below the MDA prior to reaching the VDP and acquiring the necessary visual reference with the runway. Pilots not equipped to receive the VDP should fly the approach procedure as though no VDP has been provided. The VDP will be identified on the profile view of the approach chart by the following symbol; v, as depicted in Figure 2. This depiction shows that the VDP is at the 5 DME.

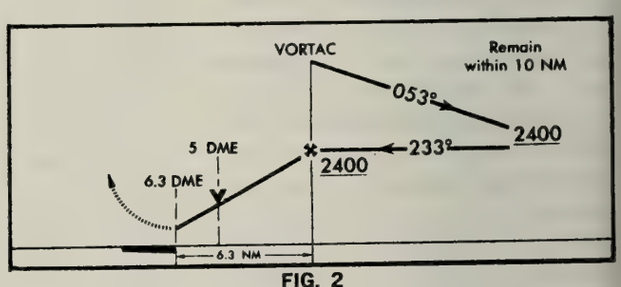


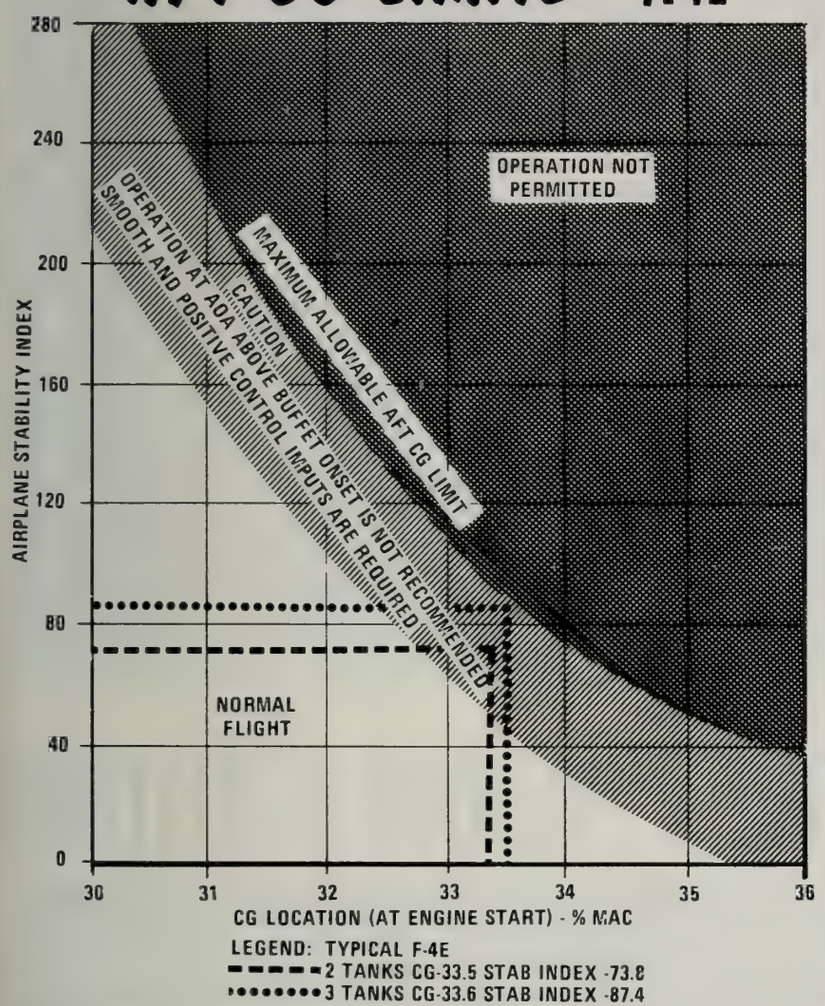
FIG. 2

Instrument flying procedures are written by pilots, for pilots. If you have any questions or comments, call us on AUTOVON 487-4276 (Directives) or 4274 (Procedures).★

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HOW STABLE IS YOUR F/RF-4?

MAJOR PAUL L. TILEY, Directorate of Aerospace Safety



F-4 drivers have known for a long time that under some configurations their aircraft is sensitive in pitch—longitudinal stability. The latest change to F/RF-4 Dash Ones includes an expanded discussion on longitudinal stability. But, two recent mishaps indicate that some of our F/RF-4 drivers don't appreciate the problem of longitudinal stability.

How do you know if you've got a problem? The AFT CG LIMITS chart in Part I of the Performance Data of your Dash One will show you if your aircraft configuration falls in the yellow CAUTION area. You need CG at engine start and Stability Index to determine this. The CG information for your "standard" configurations can be obtained from your Flight Crew Information File (FCIF) or your wing maintenance Quality Control personnel. The Stability Index can be calculated from your Dash One, or your maintenance Quality Control personnel may also have calculated it.

Does it sound like a lot of trouble? A survey of some "standard" configurations shows:

- F-4C/D/E's with typical range loads ALL fall in the yellow CAUTION area.
- RF-4's with "Two Bag" and "Three Bag" configurations fall in the yellow CAUTION area.
- F-4E's with "Three Bags" fall on the edge of the yellow CAUTION area and the red PROHIBITED area.

When you go out to fly ACM or BFM do you know if you fall in the yellow CAUTION area?

If you have been encouraged to check your standard configurations—GOOD. For further study, F-4 drivers might want to look into the benefits and ramifications of the number 5/6 lockout. RF-4 drivers may feel that their configurations don't change much, but there have been two incidents when a pilot took off without any cameras or ballast up front and lost the aircraft.

The majority of F/RF-4 drivers have too long assumed that "somebody else" is looking out for them when it comes to CG and loading configurations. True, your Quality Control personnel have to check these areas, but their only responsibility is to be sure the configuration does not fall in the red PROHIBITED area. It is **your** responsibility to anticipate and avoid control difficulties by knowing whether your configuration falls in the yellow CAUTION area. ★



Figure 1—AAU-34 counter drum pointer altimeter.

Maintain Your Present Altitude

RONALD L. LAMBDIN
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One of the most important flight parameters that is monitored by the pilot during every flight is the barometric altitude of the aircraft displayed on his altimeter. How important is this parameter and how accurate must it be to achieve safe operation in flight? These are questions that must be and have been considered during the evolution of aircraft altimeter systems as they exist in the USAF aircraft today. How and why this evolution took place are the answers you must have in order to fully understand the concern over system accuracy and how it should be maintained.

In 1963 the Department of Defense (DOD) joined with the Federal Aviation Administration (FAA) in a program designed to establish more positive air traffic control and to ensure safe control of all air traffic within the nation's airspace. This program, known as the "DOD AIMS Program," involved the addition of capability in all aircraft for automatic aircraft altitude and identity reporting. It became obvious early in this program that to achieve reduced altitude sep-

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aration and still prevent midair collisions, it would be necessary that the altitude information presented to the pilot and the controller be accurate and reliable.

The DOD directive that established the AIMS Program assigned a requirement for an altimetry system with an accuracy of ±250 feet on all military aircraft. This value of system accuracy was established through various studies by NASA, FAA, and DOD. It was concluded that 250 feet was the maximum error that could be allowed in 1000 ft vertical separation airspace. The state of development of aircraft altimetry systems at the time that the DOD directive was issued was such that few systems if any could meet the ±250 feet requirement. Most operational aircraft were equipped with a three-pointer altimeter and flush static ports as the primary source of static pressure. For the military to comply with the direction it became obvious that new equipment had to be developed. The altimetry system that was developed includes the servo-pneumatic counter drum pointer altimeter (Figure 1), an altitude computer, and a pitot-static tube (Figure 2). Each component of the system was designed to meet accuracy requirements necessary to ensure that the overall ±250 feet system accuracy requirement could be achieved.

At this point an explanation of system operation seems necessary. Total and static pressures are sensed by the pitot-static probe and transmitted through tubing to the computer. The computer converts the pneumatic pressures to an electrical analog signal of altitude and then transmits that signal to the pilot's altimeter. The altimeter then converts the electrical output of the computer to an interpretable display form for use by the pilot.

Since aircraft pressure altitude is determined by sensing the ambient air pressure and converting it to an output proportional to altitude, the sensing of accurate static pressure thus becomes very critical in achieving an accurate altitude display. Due to its theory of operation the static pressure sensing device presents a difficult problem in achieving a system accuracy of ±250 feet or better. Because of aircraft and/or sensor influence on the pressure of the surrounding ambient air, the static pressures sensed by the pitot-static tube differ significantly from the actual or true ambient pressure particularly on high performance aircraft. This difference is a function of the aircraft mach number and is commonly referred to as "position" error. The computer includes a correction device which can compensate for this error in static pressure and provide a true altitude signal to the display if the position error is known. The objective becomes finding a repeatable and known value of position error.

The altimeter and altitude computer performances are verified by the manufacturer during production and by logistics and field personnel on the aircraft during altimeter field elevation check and during system ground checkout. The pitot-static tube on the other hand is the basic and most critical component of the system having the largest and most difficult-to-define errors and most uncertain accuracy. This performance of the pitot-static tube, unlike the other components of the system, can only be determined in flight as installed on the aircraft due to the fact that its operation is totally dependent on the aircraft flow field. In flight measurements against a calibrated standard such as a pacer aircraft, therefore, must be made to verify performance and accuracy.

Figure 2—lower left, nose mounted pitot static tube. Lower right, fuselage mounted pitot static tube.



Maintain Your Present Altitude continued

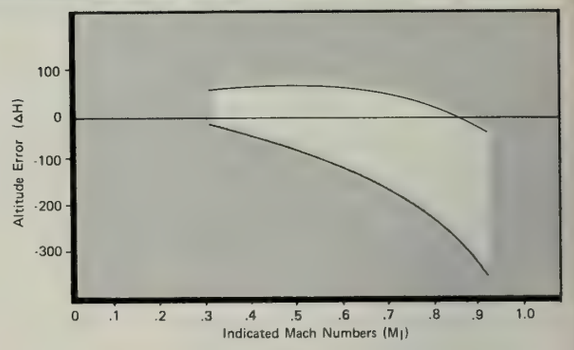


FIGURE 3. T-38 DATA ENVELOPE

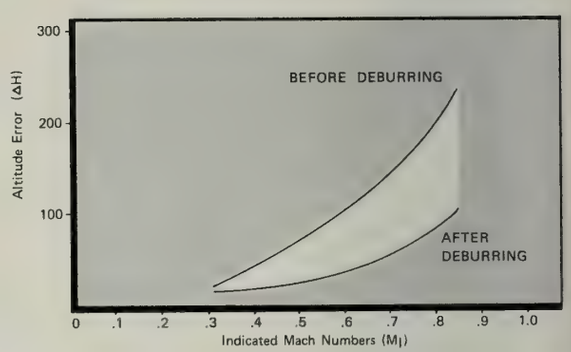


FIGURE 4. FLIGHT TEST DATA – EFFECT OF REWORK

Since it was necessary to retrofit most aircraft with a new pitot-static system for the DOD AIMS Program a series of flight tests on each aircraft was necessary to define the position error. In most cases the flight testing was conducted on only one prototype aircraft of each type and involved the identification of the position error for the aircraft for inclusion in the computer. Once this was accomplished, the correction was mechanized in a protoype computer and flight testing was repeated until it was verified that the system would meet the ±250 feet requirement. Once this was completed it was assumed that the pitot-static error was adequately defined for a series of aircraft and all aircraft of that series were retrofitted with the system as flight tested. Was this assumption valid? Are those calibrations still adequate for systems that have been operational for up to 10 years? What factors, if any, cause a pitot-static system to vary from its original calibration?

The design of static pressure sensing systems is very susceptible to variations in the condition of the sensing element. Of course, variations due to differences in manufacturing tolerances are the most obvious to consider. Such variations are controlled with adequate quality inspections and by comparison with a standard tube during manufacturing. Other factors, however, occur as a result of operational damage to the tube or system on the aircraft. Some typical factors are deformation/physical damage, foreign material in the static orifices, variations in aircraft skin (flush static port installations), errors due to system leakage, and variations in tube mounting.

It may be properly assumed that such conditions exist on military aircraft due to the environment under which most aircraft systems are maintained. Data to support this conclusion exists on the F-104, F-4C, T-38 and A-7D aircraft and is summarized below. A test program was conducted by AFFTC on four F-104 aircraft equipped with a nose mounted pitot-static tube to determine position error repeatability and to determine if the position error correction in the F-104 was representative of operational aircraft. The data shows as much as 200 feet variation may exist between F-104A type aircraft in the high mach cruise flight regime.

Standard F-4C/D aircraft are equipped with flush static ports and were not retrofitted with new pitot-static tubes. A visual inspection was conducted on the flight test F-4C aircraft and revealed that the static ports were not aligned to the tolerances as specified in USAF F-4 technical orders. Tests were conducted at AFFTC on the F-4C with the static ports in various configurations. The data indicates that variations in static port alignment can create a variation of up to 300 feet in altitude error at high subsonic mach numbers. Several operational F-4C/D aircraft were inspected and it was concluded that approximately 70 percent of operational systems did not meet TO requirements. From the data derived from the F-4C testing and the results of other studies it may be concluded that aircraft equipped with flush static ports are more susceptible to large variations in position error and that on some aircraft these errors can be of such a magnitude as to cause the total system not to meet the ±250 feet requirement.

Considerable flight test data has been collected on the T-38 aircraft nose mounted pitot-static system since the aircraft was developed (Figure 3). The correction data for the computer was based on the data collected during the initial calibration conducted in the early 1960's. As a result of later

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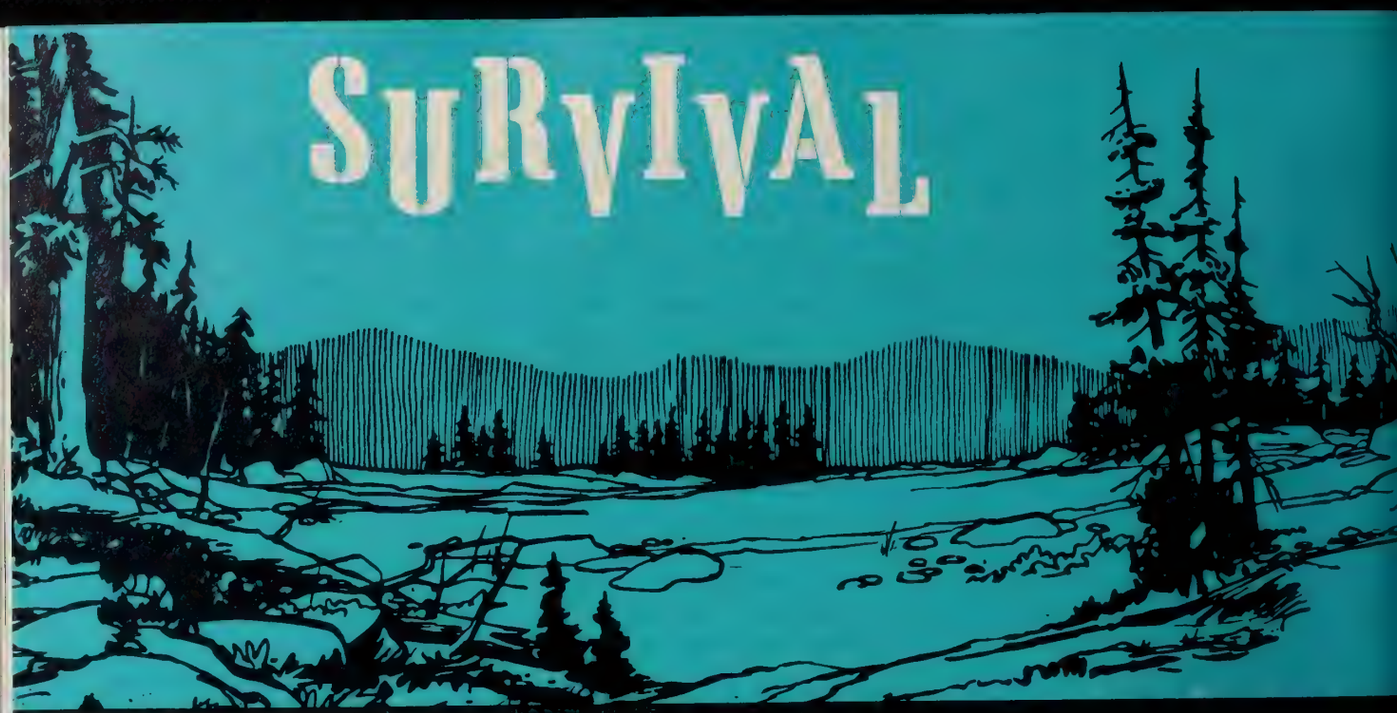
testing, it became clear that the correction curve might not be representative and that the T-38 pitot-static system accuracy was not repeatable. The most significant outcome of the test program on the T-38 aircraft is data showing the effect of static ports deformation on position error. A pitot-static tube was chosen from the T-38 test fleet and was deburred and retested. Variation as large as 180 feet (Figure 4) in altitude error was caused by burrs in the static port on that particular tube. Another significant finding was obtained from the flight testing on four T-38 aircraft equipped with their own production pitot-static tubes. The four aircraft consisted of three new aircraft and one older aircraft. The results of the flight tests showed that the position error on the new aircraft matched the position error obtained with new production and reworked tubes. The older aircraft showed a position error much different from the position error shown on the other three aircraft. The data from the test showed approximately a 120 foot difference between the older and new installations. Visual inspection revealed that the tube on the old aircraft showed evidence of erosion, appeared to be out of round, and at least one port was partially blocked. Obviously this was an older aircraft with an older tube and had been subjected to much more abuse than had the newer tubes on the other three aircraft. It is clear that there can exist considerable variation in the pitot-static system position error between T-38 aircraft. It is also clear that some of the data scatter could be reduced with a program of periodic inspection of the static ports.

The A-7D is equipped with L-shaped pitot-static tubes. As much as 200 feet variation was noted between four A-7D aircraft during flight testing at AFFTC. It is interesting to note that these aircraft were tested in controlled conditions during which the tubes were checked for damage, and removed and replaced when necessary and the static system was inspected and leakage was maintained at the minimum level possible. The conditions for the AFFTC tests must, therefore, be described as better than the normal operational environment. If such a variation can be encountered in near ideal conditions, then the variation in the field must be larger.

At this point, several items of concern have been identified but only a few answers have been presented. The importance of altitude information and the required accuracy has been shown. Action taken so far by the USAF and other military and civilian organizations to achieve a goal of safer operation in the nation's airspace has also been presented with some shortcomings. The main point of all the information and data presented is that altitude information cannot and should not be taken for granted. The efforts of field level personnel in maintaining accurate systems are just as important as that of the flight test pilot or engineer in achieving an accurate system initially. As discussed previously, the altimeter and computer are tangible items that can be checked with field test equipment to determine accuracy. The pitot-static tube is not so simple as one would think. The tube can only be checked for precise operation with a formal flight test. There are methods, however, for field personnel to determine whether or not a tube may or can be suspected as being bad. The most obvious method is a close visual inspection by field maintenance or even flight personnel. If a tube is bent, deformed, eroded, scratched, burred or otherwise damaged in the vicinity of the static ports then the integrity of the tube is questionable. Care must be taken when installing a new tube to follow proper installation procedures and take care to avoid ground damage.

Operational pilots can also do their part in this effort. One method would be to perform a makeshift flight test during formation flying. Each aircraft in this method would be considered as a "pacer" for each and every other aircraft in the formation. Each pilot monitors the altimeter reading and verbally communicates his reading to the other pilots. Any large disparity on one or more of the aircraft would be noted and would then be reported to the ground maintenance personnel after landing. Ground checks of the computer and altimeter could then be made and if those checks showed both components to be within required accuracies then it could be logically concluded that the pitot-static system/tube was bad.

ASD is continuing work in this area to better define system accuracies and to establish criteria and methods for better maintenance of aircraft systems. Consideration is being given to periodic flight testing either at time of aircraft overhaul or at a qualified test facility such as AFFTC. In the meantime the only way we in the USAF can be sure of our system integrity is to provide proper maintenance of the system. The methods described above are suggestions as to how to accomplish this action and to assure safe operation. The next time you witness someone using a tube for a step or a chinning bar, or polishing the ports, just remember that is not the way to maintain your present altitude. ★



Your Problem, Too

CAPT RONALD E. VIVION, Operations and Requirements Branch 3636 CCTW, Fairchild AFB, WA

"Sir, Captain Smith, reporting for duty."

"C'mon in, Captain Smith. Have a seat. We've been expecting you for some time. Glad to have you aboard, and welcome to Survival."

"Thank you, sir. I'm glad to be here."

"Good. Well, before I start my in-brief, let's get acquainted. Your first name is Tom, isn't it?"

"Yes, sir."

"OK, Tom, I understand you're coming from F-4's. I think you'll find survival both interesting and rewarding. We have a great bunch of guys here who are dedicated to a worthwhile mission—saving lives. Have you gone through any of our courses?"

"Yes, sir. I went through basic survival here at Fairchild in 1969 and then the Jungle School at Clark AB that same year before my first tour in SEA."

"Well then, you know pretty much what we're all about. And I'm counting on your background to help us out. I don't mean to put you under the gun immediately, but we have a problem around here that you might be able to solve for us. Give us sort of a fresh look at an old forest, so to speak."

"What's that, colonel?"

"Well, it concerns the scope of our training and our capabilities. What did you think of our course when you went through?"

"It was fine, but I don't want to ever go through it again."

"Why?"

"Well, I don't enjoy being harassed and called names and chased through the forest at a high rate of speed."

"Did those things happen to you?"

"Yes, sir."

"Well, did you learn anything at the schools?"

"Yes, I suppose I did. I learned never to get shot down and never to get captured."

"Besides that, did your attitude about your own abilities change any?"

"Yes, sir, now that you mention it. The first thing I did after I got home from Fairchild was to take my wife on a long hike in the woods, and I'm not a woodsey guy. I felt more confident somehow. Actually, I was rather proud that I had made it through the training."

"OK, how about today? Do you still feel that confidence?"

"Yes, sir. That's the thing I remember most about Survival. I

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don't remember all the specifics, like how to make a jerky rack for curing food or what type of fire to use, but I still remember how I felt when I finished."

"OK, Tom. The specifics are the key to the problem I mentioned. When you went through our schools, did we teach you about equipment items like the radio, and what was in your kit?"

"I really don't remember."

"Well, in the F-4, what type of survival radio did you carry?"

"I think it was the PRC-90, but I'm not really sure."

"When you were in SEA, did you carry any radios?"

"YES, SIR. I carried two URC-64's with spare batteries. They were in my vest and I treated them with respect."

"Why the difference? In SEA you knew a lot about the radio in your vest, but today you're not sure?"

"Well, in bad-guy country that little jewel was my only way out, and the chances were pretty good of having to use it."

"OK, back to my question then. Where did you learn about the radios if you can't remember whether or not they were taught in Survival?"

"The PE troops at the life support shop went over them with us. We had annual training and, of course, the initial check-out in the aircraft, and in SEA we checked both radios daily. That helped a bunch."

"OK, Tom, I'll stop beating around the bush. When you went through Survival you **were** taught the equipment. But, like the difference between today and SEA, the motivator wasn't there. But more importantly, and here's our problem, we were and still are very limited in the amount we can cover with each crewmember. For example, a survival instructor picks up a crew of students and asks what aircraft types are represented. Out of the eight students, he is liable to get one intelligence specialist, a C-141 loadmaster, two F-4 drivers, a B-52 navigator, a tweet IP, an A-7 pilot and a crew chief on a C-130. Do you think he will be able to cover, in detail, all the equipment items for each of those aircraft in the two weeks they have at Survival?"

"He might be able to if the kits are standardized, sir."

"I'm here to tell you, Tom, that they are not. Many things enter into the picture—type of mission, space available, environmental area, etc. So the survival instructor tells his students that he can cover the principles of the equipment and generally how to use it,

but the student has got to get with his life support shop for the specifics. That same student hears that quite a few times in his stay here. So, when he gets home the A-7 driver, for example, knows the principles, but it's the specifics he's missing. Now do you see the problem, Tom?"

"Well, not exactly, sir. The life support shop should be able to give him the details."

"Oh, they do—and do it well in most cases. But Tom, think back. In SEA you were vitally interested in your equipment. But lately, when was the last time you used your survival equipment, or even thought about it?"

"Gotcha, sir. What can we do, though?"

"I think if we made it easier for a crewmember to get the information, we would go a long way toward solving the problem. Also, we need a means of gently reminding him or her about the equipment. Here's an idea. Often, when faced with a large amount of information, an individual doesn't know where to begin. I mean, it's like going into the life support shop and asking them for a personal briefing on everything. The guy just doesn't know what questions to ask first."

"Sir, how about a checklist of items each student can carry home and use for briefing? It would cover the most important things and maybe simplify both his job and that of the life support troop. On top of that, it could be used as a reminder of the equipment on hand."

"Good idea, Tom. Think you could work one of those up?"

"Yes, sir, be glad to."

So ended the first conversation of a new staff officer with his boss. The checklist was made and is now being passed out to all students in our survival courses. It's reprinted below just in case you haven't seen one. It isn't designed to do more than key people to those specifics we can't cover in resident survival courses. But, the uses may be greater than they appear on the surface. How about it, stan-eval types? Do you require your "checkees" to show knowledge of their survival gear? If you do, more power to you. If you don't, that checklist may help you remind yourself of the gear on board, and then you can do your thing.

Jot down the answers on a card and stick it in your checklist binder—then you not only will know more about your equipment, but should have a better handle on **using** it.

Questions or comments concerning this article should be referred to 3636 CCTW/DOTO, FAIRCHILD AFB WA 99011, or AUTOVON 352-5470. ★

Survival Checklist

Ask the following questions of your life support technician for each of the areas below:

1. Where is it located?
2. What are the normal operating procedures?
3. What are the emergency operating procedures?

ITEMS

1. Survival Kit.
2. Life Raft.
3. Life Preserver.
4. Survival Radio.
5. Locator Beacon.
6. Lowering Device.
7. Sleeping Bag.
8. Minimum Survival Kit.
9. Personal Survival Kit.

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OPS TOPICS

GEAR UP LANDING (SOME LESSONS LEARNED)

A T-37 was making a precision approach with visibility one-half mile in thundershowers and fog. At about 1½ miles on final, the aircraft began drifting right of centerline. The GCA controller issued a series of heading corrections but at 1 mile the aircraft was too far right for a safe approach, so he directed a missed approach. The IP initiated the go-around and retracted the gear. At this point he saw enough of the runway to decide to attempt a landing. Touchdown occurred on the speedbrake with gear retracted. Although the RSU observed the gear position and transmitted on Guard, the aircrew did not hear the transmission because they had turned off the Guard receiver.

COVER ALL BASES

Following an aircraft qualification mission, a T-39 returned to home base for visual patterns. During two touch and go landings the left MLG strut compressed more than the right strut. On the final landing, the right main strut did not compress, while the left strut compressed fully, resulting in a right wing high, 18° bank attitude. Despite the crew's efforts, the aircraft drifted left. At approximately 90 knots, rudders were neutralized and nose wheel steering engaged to keep the aircraft on the runway. As the aircraft was turned back towards runway heading, a popping was felt on the right side, and the right main tire blew. The aircraft stopped wings level. Investigation revealed that internal binding in the right strut prevented normal compression until a right side load was induced. The same aircraft had landed right wing high two days previously; at that time improper servicing was attributed as the cause. The message is that units encountering a strut extension problem should not discount the possibility of strut binding.—Sqn Ldr Peter A. White, RAAF, Directorate of Aerospace Safety.

ACCIDENT REPORT

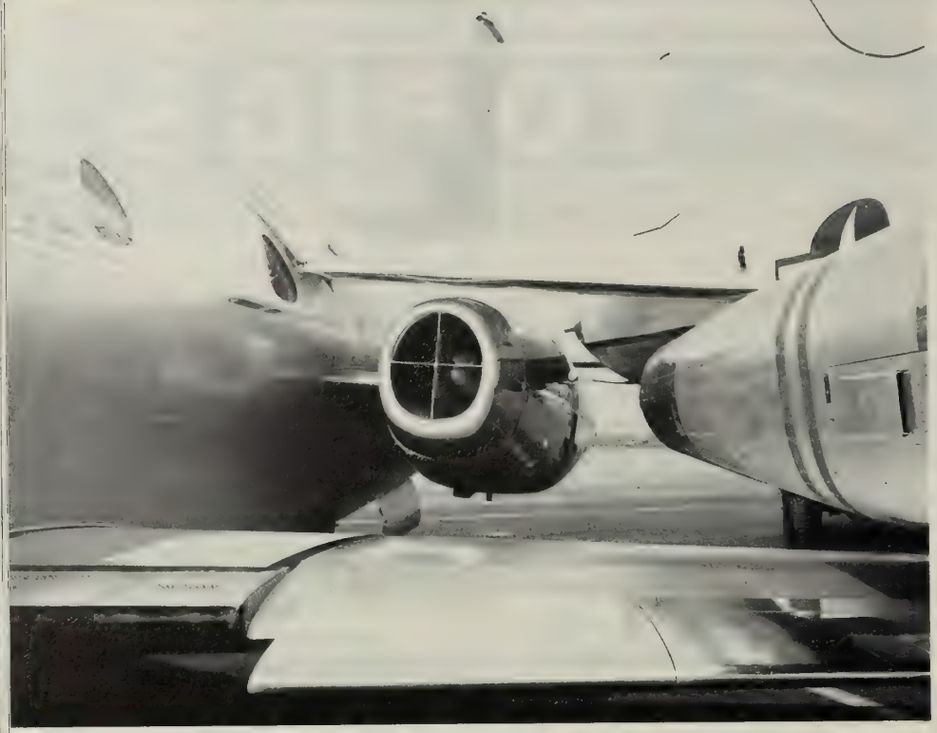
The National Transportation Safety Board has released its report on a Boeing 727 accident at Ketchikan, Alaska, in April 1976. The jetliner over ran the runway threshold, crashed into a ravine and caught fire.

The Board stated that the probable cause of the accident was "the captain's faulty judgment in initiating a go-around after he was committed to a full stop landing following an excessively long and fast touchdown from an unstabilized approach." As a contributing factor the Board cited the pilot's decision to abandon his precision approach.

In summary, the Board said the conduct of the approach, landing and post landing maneuvers was below that expected of an experienced, qualified captain. Additionally, the other flight crew members should have recognized the progressively deteriorating situation and taken positive action to correct a dangerous situation.

A LOTTA DIRT

The FAA reports in *General Aviation Inspection AIDS*, that when wheel fairings were removed from a Piper PA-28, 23 lbs of dirt were found in each fairing. The aircraft had been flying from an unpaved runway. Some of our aero clubs must operate off dirt at times, so this is an item that should be checked. Otherwise, who knows, the fairings might collect enough dirt to freeze the wheel and cause a blown tire. ★



taxi anyone?

WHAT PRICE CARELESSNESS?

MAJOR CLEVELAND SIMPSON
Directorate of Aerospace Safety

Within the Air Force, most of the attention on aircraft mishap prevention is focused on those mishaps associated with flight. This is, perhaps, as it should be, since flight mishaps are apt to have the most serious consequences in terms of destroyed aircraft, damaged property and loss of life. However, the Air Force suffers dozens of aircraft ground mishaps each year which, although not normally as spectacular or costly as flight mishaps on an individual basis, nevertheless causes millions of dollars in damages and seriously impact mission capability.

Since CY 1970, there have been more than 600 mishaps involving improper aircraft ground operation at a cost of 47 million dollars! Taxiing mishaps accounted for fully one-third of the aircraft ground mishaps experienced by the Air Force during the period 1970—April 1977.

While the typical taxi mishap generally results in acutely embarrassed crew members and only slight or minor damage to aircraft, such as a crumpled wing tip, it can be every bit as spectacular and costly as its in-flight counterpart. A classic example was a mishap which occurred some time ago involving a tanker aircraft participating in a simulated launch exercise. While being taxied back into its parking spot, the aircraft sustained major damage when the left wing tip struck an 82-foot, single bank mass apron lighting tower. The impact sheared off the left wing tip and caused the light tower to collapse on top of the aircraft, piercing the fuselage and puncturing both the aft body and upper deck fuel tanks. The primary cause (which was used then) for this mishap was pilot error in that he did not taxi so as to maintain sufficient clearance to avoid an obstacle. Contributing causes were (1) taxiing too fast for existing conditions, (2) failure on the part of ground marshallers to take action in sufficient time to properly recover the aircraft and, (3) failure to ensure that a standardized taxi reference was established on the tanker alert ramp.

A subsequent, more tragic mishap resulted in several crew fatalities and the destruction of both aircraft when two KC-135's collided while taxiing out at night on a simulated launch exercise. In this case, the primary cause was failure on the part of supervisors to provide the necessary procedures and guidance to preclude occurrence of the mishap. Contributing causes were (1) failure on the part of both pilots to take all available precautions to ensure adequate clearance during taxi, (2) lack of ramp lighting in the alert parking area, (3) restricted visibility due to moisture condensation on cockpit windows, (4) pilot distraction while

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adjusting thunderstorm lights and, (5) inadequate airfield marking of alert parking spots and taxiway lead-ins to afford safe separation for aircraft free-flow movement.

Although the above mishaps are somewhat dated, they reflect the same general cause factors commonly seen in the most recent mishaps of this type. The fact that these cause factors are still prevalent in our current mishaps indicates that we have learned little in this area over the years. Although the Air Force has experienced few taxi mishaps of the same magnitude in the past couple of years, this is attributable to an incredible stroke of good luck rather than the imposition of effective preventive measures. Given the right circumstances, it only takes a small mistake to initiate a catastrophic mishap.

A review of mishap data for the period 1970 through April 1977 confirms that people are still making the same mistakes as the ones which led to the two mishaps noted above.

The causes of most taxi mishaps fall within the broad categories of operations, logistics or support. The most common causes within each category are shown in the following paragraphs.

OPERATIONS

By far the most frequent cause of taxi mishaps is pilot error. Typical mishap findings are:

(1) Taxiing too fast for existing conditions.

(2) Failure to maintain sufficient clearance to avoid an obstacle or another aircraft.

(3) Failure to use wing walkers in accordance with Air Force Regulation 60-11.

(4) Improper braking technique.

(5) Taxiing off paved surfaces.

(6) Use of excessive power while taxiing.

LOGISTICS

Although pilot error is the most common finding in taxi mishaps, logistics personnel are not entirely without blame. Following are some of the more common errors on the part of logistics personnel that have led to aircraft taxi mishaps in the past.

(1) Parking AGE too close to aircraft.

(2) Failure to warn the aircrew of insufficient clearance in time to prevent a collision.

(3) Leaving AGE and other vehicles unattended on an approved taxiway.

(4) Parking aircraft improperly on the parking ramp.

SUPPORT

Within this category, deficiencies in airfield facilities were the predominant contributors to taxi mishaps. Some of the more common findings are:

(1) Taxi areas not properly marked.

(2) Aircraft parking spots not marked to allow sufficient clearance between aircraft.

(3) Oversaturated ramp parking areas which create hazardous taxiing conditions.

(4) Unmarked obstructions on ramp and taxiway areas.

(5) Taxi reference strips faded or not properly marked to ensure adequate wing tip clearance.

The more common types of damage sustained by aircraft during taxi mishaps normally occur in the areas of (1) wing tips (twisted, buckled or sheared), (2) drop tanks (dented or punctured), (3) horizontal and vertical stabilizers (twisted, buckled or sheared), (4) fuselage (gouged or punctured), and (5) nose (radome punctured or broken).

As might be expected, most taxi mishaps involve large transport or bomber aircraft. The obvious reason for this is the difficulty of maneuvering large aircraft on the ground. They require more room, take longer to stop, and are more difficult to see out of than smaller aircraft. On the other hand, size is not always a factor. Fighters and other small aircraft have suffered their share of taxi mishaps. Indeed, review of past mishap data reveals that the cause factor most common to all mishaps of this type is personnel error—either the result of poor judgment or plain negligence. Regardless of the aircraft's size or existing conditions, the one thing necessary for a mishap to occur is a goof on the part of the aircrew or ground personnel.

Surprisingly, materiel failure has seldom been the primary cause of taxi mishaps; it usually comes about only as the result of a chain of events initiated by some human failing. A good example is failure of the landing gear because the aircrew misjudged the aircraft's distance from the edge of the taxiway and taxied off the paved area.

In reviewing the literally hundreds of mishaps of this type, one is driven to ask the question "How can the same mistakes keep happening over and over again during a simple routine operation such as taxiing an aircraft?" The question provides a clue to its own answer. By their very nature, simple, routine tasks seem to breed inattention, complacency and outright carelessness in the best of us. That is what causes a pilot to attempt to negotiate a difficult turn in a congested area, without wing walkers, because he's "done it a thousand times," or a crew chief to leave a tow vehicle unattended on an active taxiway because he'll "only be gone a minute." Can't happen to you, you say? Don't bet on it! ★

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THE FUEL FLOW GAGE

HAROLD POEHLMANN
Fairchild Republic Co

Occasionally a "vintage" Aerospace Safety *magazine article has a message with as much contemporary value as it did when it was first published. "The Pilot's Best Friend" is being republished because we notice that when aircraft mishaps are in progress with air starts being a part of the "get well' procedure, aviators do not always direct their attention to the pilot's best friend, the fuel flow instrument. Not only will increased reverence toward this instrument help your in-flight "troubleshooting" but your observations of its readings can simplify accident investigations.*

There is nothing a pilot dislikes more than a "nonrated" or maintenance man giving advice on how to run his machine. However, in this case I have a message that I am certain will prove to be a thought provoker. It is based on observations from experiences dating back to the early jet flying in 1946.

In almost every accident and incident involving engine flameout which required a restart, the narration indicates the average pilot places his attention on the wrong instruments during the restart attempts. This sounds like an indictment, but it's true.

During the 1947 period, the F-84B aircraft had a fuel system placard in the data case for the pilot to consult during moments of anxiety when attempting to locate some wayward fuel. Of course, this placard portrayed three tanks, two lines, and a couple of pumps and it didn't take more than 300 feet of altitude to "dope" it out. The present day machines are a bit more complex fuel-system-wise, and you'll be at "low key" altitude before you can figure out which side of the fuel system schematic is up (in fact the fuel system schematic is no longer required to be placed in the cockpit —I guess for this very reason).

The formal reports usually state, "I opened the throttle and didn't get any rise in EGT, so I then . . .;" "I opened the throttle and the EGT didn't move, so I switched to emergency and still the EGT remained on the peg . . .;" "I pushed the airstart switch and opened the throttle and the rpm didn't increase from the windmill speed. . . ."

On every aircraft you fly, it is very necessary to be able to mentally picture the basic fuel system and remember the location of at least the following two items: Main boost pressure warning transmitter (fuel supply inlet pressure), and the fuel flow meter.

This subject boils down to a simple statement of fact; you can't start an engine if there is no "juice" available. If fuel is not available, don't waste time making airstarts until you correct the condition. Your morale is bound to go out the tail pipe along with the ambient air on each non-start attempt, so favor the adrenaline producing organs by making the first start productive. This can only be accomplished by glueing your eye to the fuel flow instrument during the initial start technique. It is not my desire to get involved with altitude, airspeed and other special aircraft model requirements, but the fuel flow is the primary ingredient for a light-off. This is the most important instrument observation during an in-flight airstart. It will indicate if the engine is receiving fuel; if it reads zero, save your time and put your limited attention on the aircraft fuel supply system, i.e., warning lights, selector position and liquidometer readings, and other fuel supply paraphernalia. A knowledge of the fuel flow instrument power source is a good idea in order to ensure the instrument has power during the emergency period.

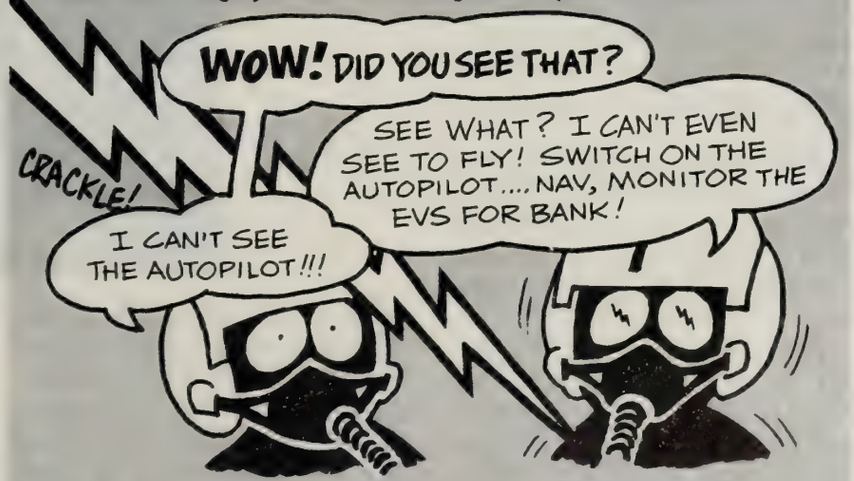
Obviously if the main boost light is illuminated, it is signaling there is low or no fuel flow from the aircraft boost system and in all probability the fuel flow indication will be non-existent. The corrective action is obvious. As the saying goes, "first things first."

Correcting a fuel supply problem is a subject that varies with aircraft and obviously a good knowledge of the basic fuel system is of paramount importance.

Not only is the observance of the fuel flow indication important to the prompt restarting of the engine during those terrifying moments (tell the truth, they are terrifying—unless you have more than one "hot air generator"), but the most important gage reading for the ground crew or anyone attempting to reconstruct a flameout is "what" you saw on the flow meter.

The official records would surprise you by how seldom there is mention of the fuel flow reading. I remember one incident where nine airstarts were attempted, and at no time did the pilot observe the fuel flow. There is no doubt there are many instruments demanding attention, but increased use of this important fuel flow will prove to be of value in the successful in-flight starting of your jet engine. ★

Flight was scheduled as a night training sortie including low level. During an enroute descent the aircraft entered clouds at 11,000 and encountered light rain. As it was passing 6,500, wings level, lightning struck the left front of the aircraft. The flash was so brilliant that both pilots were temporarily blinded. The copilot regained enough peripheral vision in about 10 seconds to determine the attitude of the aircraft. Even after 10 minutes the pilots had difficulty focusing on instruments and felt slightly disoriented. After flight both experienced headaches.



CAN YOU FIND EMERGENCY SWITCHES WITH YOUR EYES CLOSED?

GENERAL

FLY SMARTER

The lieutenant colonel, a rated Air Force pilot, took off with a passenger in the back seat of a privately owned T-34. Minutes later both were dead—victims of an attempt to perform an aerobatic maneuver at too low an altitude to permit recovery.

Witnesses said the aircraft was flying parallel to the runway when it pulled up and appeared to enter a clover leaf maneuver. The aircraft stalled, then leveled out momentarily and finally struck the ground before completion of the recovery. The pilot violated a Federal Aviation Regulation by performing aerobatics below 1,500 ft.

If that were the only case of its kind, we would probably write it off as a fluke and forget it. But it wasn't an isolated event; in just a little over two years there have been 19 fatal general aviation aircraft accidents in which the pilot was a member of the Air Force. Eleven of those were Air Force rated pilots. Seven of the accidents resulted from loss of control—stall/spin, and in six of them the pilot was an Air Force rated pilot. That doesn't square too well with our image of the highly skilled, professional Air Force pilot. But let's get back to that later. Now some more stats.

There were 37 fatalities of which 25 were members of the Air Force. Pilot factor was the cause in 12 accidents, undetermined in six and materiel factor (engine failure) in one.

There were basically three reasons for these accidents, under the broad cause of pilot factor. They were loss of control—stall/spin; attempting flight beyond the capability of the pilot—primarily in weather—and poor judgment. Let's look at some of these.

There were four known and one suspected accidents in which the pilot attempted to fly in weather that exceeded his (and usually the aircraft's instrument) capability. For example, an A1C with a total of 70 hours flying time died along with his passenger when the Piper Cherokee 140 they were flying crashed. The pair was on a cross country when they encountered thunderstorms. The pilot descended to maintain VMC and struck the ground at 2,000 ft MSL.

A master sergeant was following another aircraft in poor weather over a mountain pass. The two aircraft stayed within sight of each other until they ran into a solid overcast. They descended through a hole to follow the highway across the pass. At the top of the pass, the lead pilot turned, and the master sergeant followed. He lost the road and attempted to climb out, but the right wing struck a tree at 4,500 MSL. Neither the pilot nor the aircraft was equipped for instrument flight.

A similar accident involved a senior master sergeant who dropped down to 30 feet above the trees while trying to follow a highway in marginal weather. He had several opportunities to land at airports along the way but declined, even though his destination was forecast to be below minimums. As he topped a ridge he encountered IMC and attempted a one-eighty. In the turn his right wing struck a tree and he crashed. Weather at the site was zero zero in fog. The aircraft was not equipped for instrument flight and no flight plan had been filed.

Weather was involved in these accidents but poor judgment appears to be the real cause factor, as in the following case. A young airman took a civilian friend for a ride in a Grumman TR-2. With a total of 100 hrs flying time, he probably had more confidence than skill and knowledge. They were seen flying



A good pilot will approach a flight in a bug smasher in the same concerned manner he

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AVIATION

across a lake at less than 100 feet. They flew into a box canyon and tried to make a one-eighty, but there wasn't room and they crashed into the canyon wall. The canyon is three miles long by 500 feet wide and 300 to 3,300 feet deep.

These cases involved pilots with relatively low experience. While they are certainly regrettable, they are typical of many general aviation accidents that occur each year.

What is disturbing is the professional pilot who apparently misjudges his aircraft's capability in relation to his own skill. Few USAF aircraft today equip a pilot to fly aerobatics in a light plane without considerable practice and the exercise of good judgment. An example is the accident involving the lieutenant colonel in the T-34.

Here's one with a different twist but same results. A lieutenant and a passenger were killed when the Cessna 120 the lieutenant was piloting crashed. He attempted a maximum performance climb from 300 ft, ran out of airspeed, stalled and . . . the inevitable. The lieutenant was an Air Force helicopter pilot with 200 hours of general aviation time.

Another tragic crash claimed two lives. An Air Force rated captain had built a BD-4, a high wing monoplane. The pair loaded the aircraft with, among other things, a motor bike. The aircraft was estimated to have weighed at least 1,950 lbs at takeoff. According to witnesses, the captain started the engine and immediately taxied to the runway where he made a quick mag check and rolled. The takeoff was up hill and the aircraft accelerated slowly. Finally it became airborne and gained enough altitude to clear some trees. Then it stalled, nose high, and descended through the trees to the ground where it burst into flames.

Another Air Force rated pilot, a lieutenant, allowed a Cessna 150 to stall with fatal results for himself and a passenger. They were attempting slow flight at 200-400 AGL, over 7,400 ft terrain. The aircraft stalled, entered a spin and impacted 45° nose low. A possibility in this accident is one that frequently causes trouble. All of the lieutenant's previous light aircraft time was in a T-41 with 210 horsepower. The Cessna 150 had 100 horsepower, a big difference especially at altitude.

That accident is reminiscent of one that occurred a few years ago when a woman pilot failed to clear a ridge shortly after takeoff in a Cherokee 140 from a strip at 7,000 feet. The Cherokee just couldn't make it, and the aircraft stalled and crashed. The pilot's experience had been in an aircraft with much higher horsepower.

One of the things that the military pilot who flies light aircraft must remember is that the laws of physics apply to the light plane in exactly the same way as they do to a supersonic fighter or a many-engined bomber or transport.

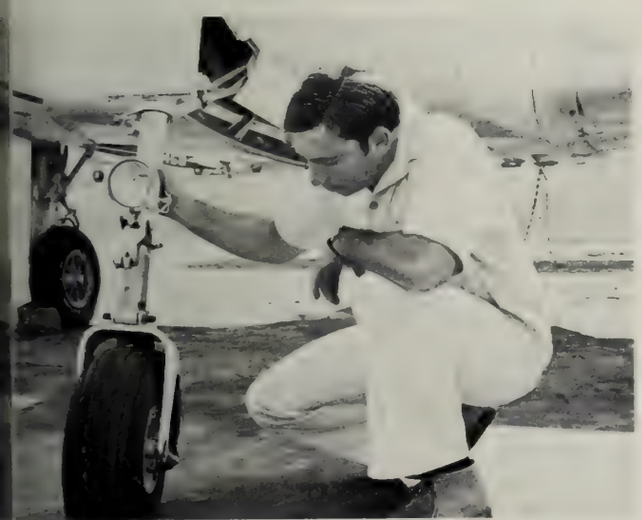
Two lieutenants apparently forgot this while attempting to stunt a Luscombe 8A. The aircraft stalled and spun to the ground. In every case of this type over the past two years, the maneuvers that the pilots were attempting were performed at such a low altitude that, in the event of a stall, recovery was impossible.

Flying light aircraft is great fun, but those airplanes are not toys. You have to know the rules and obey them or the little airplane will let you kill yourself. If pilots attempt to fly in weather without proper instrumentation or the skill to fly on instruments, then they can expect trouble. And that's not very smart.

If you want to fly aerobatics, fine, but do it at an altitude high enough to permit recovery in case you stall.

If you are going to accept the responsibility of carrying passengers, you owe it to them to not take unnecessary risks.

If you fly light airplanes, think about the fact that with one—possibly two—exceptions all of the 19 fatal accidents in this study resulted from poor judgment on the part of the pilot. ★



would in a high performance job. Just because it's fun doesn't mean you can take it lightly.

MAIL & MISC.

Send your thoughts, ideas, comments,and questions to:
Editor, Aerospace Safety Magazine — AFISC/SEDA — Norton AFB, CA 92409

MAJOR GENERAL BENJAMIN D. FOULOIS MEMORIAL AWARD

1. Congratulations to the ANG for winning the Benny Foulois Award for aircraft accident prevention in 1976 (back cover, March 1977 **Aerospace Safety**). This award is the oldest of Daedalian Trophies, and is the one most intensely sought by us TAC-types.
2. If you want to call it a "USAF Safety Trophy," OK. But how about a little credit to the Order of Daedalians (the fraternity of military pilots), who are the **real** presenters of this trophy. Daedalians champion the cause of flight safety in all the services and among the air carriers, presenting trophies in each category.
3. We owe us one.

CHARLES B. NEEL, Lt Col, USAF
Chief of Safety, 4TFW (TAC)
Seymour Johnson AFB NC
Flight Captain, Kitty Hawk Flt (No 8)
Order of Daedalians

Reference the back cover of the March 1977 **Aerospace Safety** magazine.

We Daedalians were somewhat amazed to learn that the Major General Benjamin D. Foulois Memorial Award has become a USAF Safety Trophy. We were always under the impression it was a Daedalian Award since its conception in 1938 when it was first presented to the 19th Bombardment Group.

Incidentally we have it here in the office ready to present to the Air National Guard on the 21st of May in Denver, Colorado.

THEODORE W. GUY, Col, USAF (Ret)
National Adjutant
Order of Daedalians
Kelly AFB, TX

You are correct; we were remiss. The Major General Benjamin D. Foulois Memorial Award—formerly the Daedalian Trophy—is presented by the Order of Daedalians to the major command with the most effective aircraft accident prevention program for the preceding year, as selected by the Air Force. Thanks for calling this oversight to our attention.—Ed.

Outstanding airmanship and a professional approach to flying are not limited to rated aircrews. The following story is an example of exemplary flying skill and judgment.

MSgt Gary D. Arthur is a certified flight instructor for the England AFB Aero Club. Just before sundown, during a cross country flight with two student pilots, the engine of the Cessna 172 failed at approximately 2,500 feet AGL. MSgt Arthur took control of the aircraft and set up a glide. He had been keeping track of the aircraft position and knew that there was a landing strip nearby. Although the strip was closed, MSgt Arthur was able to sight the runway at about 3 miles. He advised the controlling agencies of his plight and then executed a perfect engine out landing in the gathering dusk.

Although MSgt Arthur is not eligible for the USAF Well Done Award, his actions are in the same fine tradition of those USAF crew members so honored. The staff of **Aerospace Safety** wish to congratulate MSgt Arthur for his fine performance and outstanding airmanship.

A FORECAST UPDATE

	1977 FORECAST*	MISHAPS as of 2 Jun 77
Control Loss (Pilot)	8	4
Collision with Ground (Nonrange)	8	5
Collision with Ground (Range)	6	3
Midair Collision	6	1
Landing (Pilot)	12	4
Takeoff (Pilot)	3	0

*Includes all Class A but only Class B mishaps with losses greater than $50,000.

In April we told you about the 1977 mishap forecast. We also asked you to help prove the forecast wrong. This month we are giving you a how-goes-it report on those categories that are locally preventable. The right hand column above shows how many mishaps we've had in the categories. As you can see we aren't doing much to prove the forecasters wrong. We really need your help for the rest of the year, if we are to achieve any reductions in mishaps. ★

Name That Plane



This advanced concept aircraft was a ray of hope for advocates of strategic air power. For answer see inside front cover.



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TED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



FIRST LIEUTENANT
Alan C. Stockstad



FIRST LIEUTENANT
George F. Nemeyer, Jr.



CAPTAIN
Bruce S. Bennett



TECHNICAL SERGEANT
Charles A. Burnette



SERGEANT
Daniel A. Bordessa

50th Tactical Airlift Squadron
Little Rock Air Force Base, Arkansas

On 13 October 1976, Captain Bennett and crew departed Frankfurt AB, Germany, for a flight to Italy in a C-130E. Approximately one hour enroute, the right hand AC Bus OFF light illuminated, and the number four generator was turned off. Minutes later, the generator failed with both voltage and frequency dropping to zero. Reset attempts failed and the engine was shut down. Captain Bennett declared an emergency, requesting an immediate return to Frankfurt AB. Shortly thereafter, number three generator out light illuminated and the flight engineer could not reset the generator. Captain Bennett decided the emergency warranted an immediate landing. During descent the number two generator failed and the ATM generator was checked and turned on. At 10,000 feet MSL, Captain Bennett requested the lowering of gear and flaps. The loadmaster, Sergeant Bordessa, confirmed the gear was down and locked and the flaps were down. When the number one generator failed with no response to resetting, radio contact with Nancy/Ochey, France, Approach Control was established and vectors to a PAR approach requested. The controller reported a 500-foot ceiling with one mile visibility. Then the ATM generator failed leaving the aircraft operating on battery power; however, prior to DH the aircraft battery lost power and all electrical systems failed. At 300 feet above the ground the aircraft was clear of clouds. The runway was sighted approximately one-half mile ahead and the landing was made on three engines. The professional competence and prompt reactions of Captain Bennett and crew not only prevented the loss of a valuable aircraft, but also averted possible injury or loss of life. WELL DONE! ★



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SAFETY AUGUST 1977



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Major General Ranald T. Adams, Jr. has departed his position as Commander of the Air Force Inspection and Safety Center (AFISC) to become the Director of the Inter-American Defense College at Fort McNair, Washington, D.C.

Major General Richard E. Merkling, the former Director of Aerospace Safety at AFISC has moved into the command position.

Brigadier General Garry A. Willard, Jr. has arrived from Korea to become the Director of Aerospace Safety. We wish all three much success in their new assignments.

AUGUST 1977

UNITED STATES AIR FORCE
aerospace SAFETY

THE MISSION - - - - - - SAFELY!

LT GEN JOHN P. FLYNN
The Inspector General, USAF

MAJ GEN RICHARD E. MERKLING
Commander, Air Force Inspection and Safety Center

BRIG GEN GARRY A. WILLARD, JR.
Director of Aerospace Safety

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Staff Photographer

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A LITTLE JOLT'LL DO YA!
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NAME THAT PLANE

BOEING P-26

This new all metal low wing fighter was a major departure from the outdated designs previously in production. There were a total of 130 P-26's produced at a cost of $10,000 each.

Specifications
Length—23' 7¼"
Height—10' 4"
Span—27' 11⅝"
Gross wt—2935 lbs
Armament—two ea .30 cal or one .30 and one .50 cal
Power Plant—P & W, R 1340, 600 HP
Max Speed—234 mph
Cruise—205 mph
Range—570 NM
Service Ceiling—27,400 feet

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, US

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AUGUST 1977 AFRP 127-2 VOLUME 33 NUMBE

The Mission Safely

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AT URBANA-CHAMPAIGN

As I review the accomplishments of the last two and a half years, and turn the Safety Directorate over to General Willard, I believe each of you who contributed to safety during this period can be proud of your achievements. We have seen the Air Force reduce the number of flight mishaps and destroyed aircraft to the lowest level in our history. We have, as well, reduced the number of Air Force fatalities from all causes.

We have learned to predict mishap trends to a level of accuracy which is almost unbelievable and yet frequently discouraging. Discouraging because, after we have identified the causes, the numbers, the types of aircraft that are going to have mishaps, we seem unable to influence these trends to any great degree.

We have seen safety become a very active and dynamic force in the acquisition and development process, providing lessons learned, analyzing systems for inherent weaknesses and failure modes, then transferring the lessons learned from one aircraft and system to others. Here in the Directorate of Aerospace Safety we have simplified mishap reports and worked very hard to reduce the directed reporting workload which detracts so seriously from the safety officer's time available for prevention activities.

Obviously, this isn't the result of a single individual's efforts or of any small group. It has required the dedicated and imaginative efforts of many. The Directorate's Safety Action Teams, which were structured to assist program managers as well as operational commanders to achieve a better safety posture, have gained credibility to the point where they are now asked with some frequency by operating commands to assist in the search for solutions to problems.

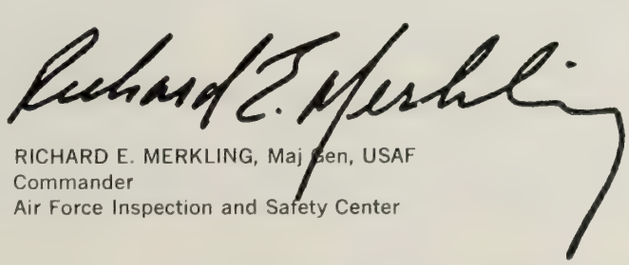
Safety is now taking an active role in the modification, definition and certification process. This can only help the Air Force use its limited modification funds in a manner that will address the most severe, significant, and costly safety problems. The Air Force leads the way in implementing, in a workable, meaningful fashion, the Occupational Safety and Health Act of 1970. Program guidance has been in the field approximately 1 year, and some 33 General Industry Safety Standards are in preparation for publication and distribution to operating units. A revised AFR 127-4 is in the final stages of publication. Reporting processes called for in this new regulation are much simplified and every effort has been made to reduce the workload of field staffs.

While much has been accomplished in the last several years, we still have certain fundamental weaknesses to overcome. New generations of commanders, operations supervisors and middle managers sometimes overlook critical areas or repeat mistakes of the past. We find we must relearn old lessons.

As we demand ever higher performance levels from our weapon systems, sophistication and complexity increase. Engines today account for some 22% of all aircraft mishaps. Materials and machine processes are being taxed to the limit. Quality assurance becomes one of the most essential, but frequently overlooked, elements in the acquisition process. Development teams change so frequently that the decisions made today are someone else's problems tomorrow. The folks who design and build don't have to support and maintain, thus their emphasis or focus is on different elements of a weapon system.

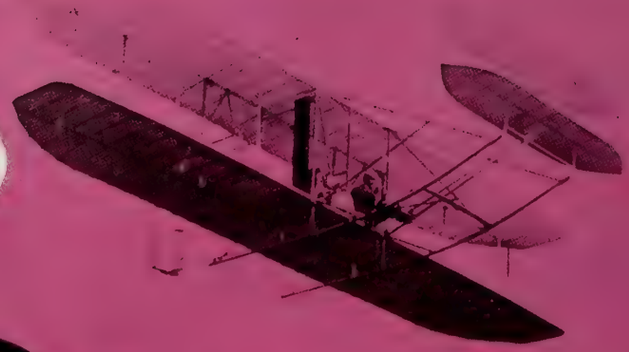
All of this points to a very interesting and continuing challenge in the area of safety. In light of the ever increasing manpower and material costs and our vital need to maintain the most capable fighting force in the world, Safety will have an ever increasing role to play. But in perspective this contribution may have to be made with one-half or even, perhaps, a third as many people as today. We need to selectively and sternly eliminate those functions which are not high payoff items and do not contribute to the primary mission of protecting our combat capability and the men and women who are our Air Force.

To those of you who continue in this most essential career field I want to extend my best wishes for continued success and thank you for the outstanding support you have given me. ★



RICHARD E. MERKLING, Maj Gen, USAF
Commander
Air Force Inspection and Safety Center

From Whence We Came



70 YEARS AND STILL GOING STRONG

MSGT DAVE SYLVA, 63 MAW, Norton AFB, CA

We stand 'neath resounding rafters,
The walls around us are bare
They echo back our laughter
It seems that the dead are all there.

Stand to your glasses steady,
This world is a world full of lies
Here's a health to those dead
already
And hurrah for the next man
that dies.

Seventy years ago, and just three and a half years after the Wrights' kite slipped the surly bonds, an innocuous memo from the Chief Signal Officer of the Army announced the establishment of "An Aeronautical Division."

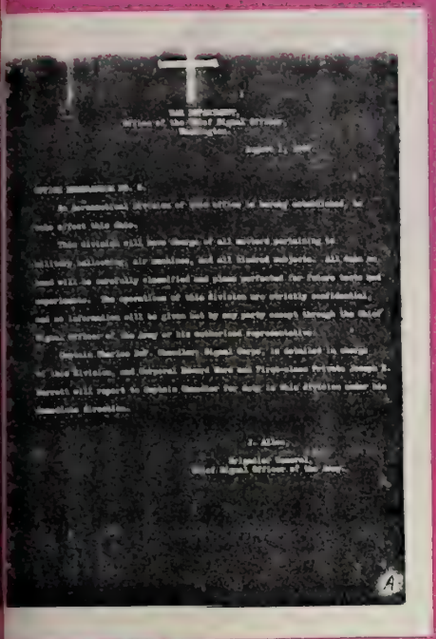
The "Division" was staffed by three men; Captain Charles DeF. Chandler, Corporal Edward Ward and First Class Private Joseph E. Barrett. Shortly after his assignment, Barrett went over the hill and cut Air Force enlisted strength by 50 percent.

In 1904, just after Kittyhawk, the Wright brothers had offered their machine to the US Government, but some bureaucrat in Ordnance and Fortifications rejected the offer saying: "The War Department declines to lend financial support to the experimental development of devices for mechanical flight." The poor dude was probably licking wounds after the attacks the Army was suffering from the Congress and the newspapers for what they called "the assinine expenditure of government funds."

Nonetheless, nearly 5 months after the "Division" was established, the Signal Corps released specification bid No. 486. Exquisitely simple by today's standards the bid required: "The construction and delivery of a flying machine supported entirely by the dynamic reaction of the atmosphere and having no gas bag." It had to be "steered in all directions without difficulty and at all times under perfect control and equilibrium." It had to be able to carry "two men weighing 350 lbs together and enough fuel to fly 125 miles." It had to "fly for one hour and had to fly faster than 40 mph." The spec order listed as desirable that "the machine be capable of being assembled and put in operating condition in about one hour . . . that it be transportable by mule wagon" and that "the machine have some device to permit a safe descent in case of an accident to the propelling machinery."

The "Division" had no plane assigned for the first two years of its existence but some flight history was made during that time. The bicycle boys from Dayton brought out their 1905 model with a new, souped-up 30 hp engine installed. They began test hops at Ft. Meyer, VA, on September 3, 1908 with a one minute, 11 second flight. Two weeks later, Orville and his passenger, Lt Thomas E. Selfridge, were just beginning their fourth circling pass over the field when the starboard prop cracked lengthwise. The result was a wooden, non-variable pitch prop that was in low pitch. As the sick propeller started windmilling, the port motor, now out of sync, began to come apart. The shaft bent and the prop came loose cutting the guy wires that held the tail planes rigid.

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Memorandum No. 6 established an "Aeronautical Division" consisting of three men.



Orville Wright before the world's most modern flying machine.





Those were the days—when aviation was young. Aircraft shown were typical of the day. Aircraft in upper photo was an early Curtiss.



Oft-published photo of Wright-Selfridge accident.

The plane literally came unglued and fell to earth pinning both flyers. Orville was hurt but young Selfridge was dying. He whispered "Take this damn thing off my back" and passed out. Without regaining consciousness, Lt Selfridge became the first Army flyer to die in an aircraft accident.

The Wright Flyer was reassembled and continued its acceptance tests. On July 27, 1909, Orville and Lt Frank P. Lahm flew 5 miles from Ft. Myer to Alexandria, VA, averaging 42.583 mph. Six days later, the newspapers announced that "The Wright machine is now Aeroplane Number 1, Heavier Than Air Division, United States Aerial Fleet."

Two months later the Wrights taught Lahm and Lt Frederic E. Humphreys how to fly their machine. With three hours of dual time, they both soloed. Another young lieutenant named Benjamin Foulois got in on the training but didn't solo.

One month after soloing, Lahm and Humphreys were logging some time when they wrecked the bird. Without a machine and in accordance with the Army's "Manchu Law" these two men were relieved from their detached duty status and went back to their regular duties—Lahm to the cavalry and Humphreys to the Engineers. The operational "Division" was wiped out. The spirit wasn't dead though.

Lieutenant Foulois and some enlisted men packed up the kite and took it to Ft. Sam Houston, Texas, where the winds were more favorable and where there were fewer buildings to hit. Foulois stayed in touch with the Wrights by mail, and through a correspondence course learned how to land the thing. We were back in business and more interest was developing.

Up until 1911, we had one bird and one pilot. Congress had not appropriated one cent specifically for aviation. The Wright Flyer had been bought out of special experimental funds. The Signal Corps sidetracked installations maintenance funds for the aviation program. In fact, Ft. Sam had budgeted only $150 for gasoline and repairs.

In March, 1911, Congress voted $125,000 for Army Aeronautics. General Allen, still Chief of Signal immediately ordered five new planes at $5,000 apiece. The first two, another Wright B model and a Curtiss machine arrived the following month.

That same month, the Curtiss School and its students, Lts Beck, Walker and George E. M. Kelly, moved from North Island at San Diego to Fort Sam. One month later, Kelly was killed in a crash and the furious commanding general barred any further flying from *his* drill field.

Lieutenants Milling, Kirtland, and Henry "Hap" Arnold joined aviation that year. Arnold who had graduated from the Point in 1907 without ever having heard of the Wrights or of Kittyhawk would go on to become our first and only five star general.

The "Division" would become the Aviation Section, then the Air Service, the Air Corps, the Air Forces and forty years after its establishment would sever the bonds with the Army and become the United States Air Force. ★

THE MISSED APP

ROBERT E. BURGIN
Air Safety Investigator
National Transportation Safety Board



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Although Air Force flying procedures and practices differ somewhat from those of the air carriers and general aviation, pilot fixation on landing is, nevertheless, a problem to all three. This paper, which discusses the missed approach and pilot landing expectancy, was presented before the 29th annual International Air Safety Seminar and Aviation Technical Exposition, Anaheim, California, in October, 1976.

The number of instrument approaches flown in the United States each year is approaching two million; few result in actual IFR missed approaches. Although the total number of approaches flown is compiled by the Federal Aviation Administration (FAA), it appears that no like comparison is being made regarding the numbers of missed approaches that occur. Because of this lack of information we are unable to determine the success rate of instrument approaches. The only statistics that deal in success rates are accident statistics where it is obvious that the approach was unsuccessful.

Pilot experience substantiates the fact that an actual IFR missed approach is an infrequent event. Pilots operating routinely in the air space system have difficulty recalling many past actual IFR missed approaches. Surprisingly, they often also have difficulty recalling the missed approach procedures for approaches that are so familiar that they have committed them to memory, not to mention the missed approach procedures for an approach that they have just successfully completed to a landing. That pilots are not attentive to the missed approach procedures is verified by my observations of crews

ROACH



while occupying the jump seat. I have rarely heard a discussion of the missed approach procedures; however, I almost always hear a discussion of the approach procedures when weather approaches minimums. While a silent review of the missed approach procedures by each of the crewmembers is sometimes observed, the approach procedures are almost always orally reviewed. Additionally, my observations are supported by the CVR tapes from accident aircraft.

In an 11 year period between 1965 and 1975, there were 48 aircraft accidents associated with the missed approach regime. Additionally, numerous landing accidents could have been prevented had the pilot elected to make a missed approach rather than to risk a poor approach or landing. What then is the cause of our lack of attentiveness to the missed approach? A possible reason may be that we are so oriented to operating in a total radar environment that we believe that the controller will take care of us should a missed approach be required. Another possibility is that the actual published missed approach procedure is rarely flown when a missed approach occurs, so why bother reviewing a procedure we will not fly. A third possibility is that the missed approach procedure is so uncomplicated that a review is not deemed necessary. A review of several approach procedures disclosed that in some cases the procedure for the missed approach is more complicated than the approach itself. Although each is a possible reason as to why we are not attentive to the missed approach, a review of the facts, conditions, and circumstances of landing and approach accidents indicates an underlying phenomenon that is prevalent in pilots, air traffic controllers, and the air traffic control structure. This phenomenon is called "landing expectancy." This paper deals with this phenomenon.

Landing Expectancy

Their decisions could be based on how they would like circumstances to be rather than what is reality.

Expectancy, or set, can be defined as an anticipatory belief or desire. Certainly the pilot anticipates that he will land and he has a desire to do so. Un-

THE MISSED APPROACH

continued

fortunately his landing expectancy, which operates at a subconscious level, affects his decision-making processes to the point where a safe landing may not become a reality. The controller also has the belief and desire for landing, although for possibly different reasons. In essence, the individual has his own rationale supporting his expectancy; that is, his expectation provides the basis for his perception. This could mean that a pilot or controller can perceive situations to be different from actual circumstances. Thus their decisions could be based on how they would like circumstances to be rather than what is reality. The landing expectancy phenomenon is derived from experience, as are the meanings attached to any stimulus. This is what leads to accidents because we become influenced by this subconscious behavior instead of by the reality of the situation. For this reason, it is important that the users of the air space system be able to control these false motivating factors.

Pilot Landing Expectancy

"Well, I am sort of programmed for landing, I am oriented to landing."

The facts, conditions, and circumstances of several recent aircraft accidents illustrate that pilots, especially airline pilots, have an expectancy to land from every instrument approach. The fact that they almost always succeed reinforces their belief. Additionally, a pilot's competitive nature can also reinforce his belief; e.g., "Eastern 421 just missed but I can hack it." An example of pilot landing expectancy occurs when we execute a missed approach while at the same time attempting to review the missed approach procedures. An excellent example of the strength of the landing expectancy phenomenon can be found in the captain's testimony regarding the recent accident at St. Thomas. When asked why he did not go around or push the aircraft onto the runway when he recognized that the landing would be longer than normal, the captain replied, "Well, I am sort of programmed for landing, I am oriented to landing."

Because pilots are so strongly oriented to landing, there is a tendency to eliminate viable alternatives and opt for attempting a landing or try such feats as beating the weather to the field, continue unstabilized approaches or descend below decision height attempting to get the airplane on the ground. Thus they can end up in situations where they can't stop the aircraft on the runway remaining nor can they go around successfully; the result—an accident.

Controller Landing Expectancy

The expectancy phenomenon can be such a strong motivation force that controllers can fail to recognize that an airplane has landed or crashed as has been the case in several recent accidents.

In addition to pilots having a landing expectancy, air traffic controllers also have certain landing expectancies. They want to get the pilot out of the system. The strength of their expectancy depends on the type of pilot making the approach. Controllers are less likely to expect that a general aviation pilot will land out of an approach than they are to expect that an air carrier pilot will land. The controllers' expectancy is based on previous experience. Their expectancy is reinforced by the information pertaining to missed approaches contained in the FAA Air Control Manual 7110.65 which bases ATC procedures on the controller's judgment that weather conditions are such that approaches are likely to be missed. Thus, if the controller doesn't consider the weather bad enough, most likely he expects the pilot to land out of every approach. Should a pilot wish to demonstrate this controller expectancy, just make a missed approach at O'Hare when the weather is below VFR but substantially above minimums and

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no one else has made a missed approach. You will rapidly learn that cleared for an approach implies cleared for the approach to land; not cleared for the approach and missed approach. To further illustrate this phenomenon, the next time you are cleared for an approach, ask the controller what he would like you to do should you make a missed approach. You may be greeted with a period of silence. The expectancy phenomenon can be such a strong motivating force that controllers can fail to recognize that an airplane has landed or crashed as has been the case in several recent accidents.

Air Traffic Structure Landing Expectancy

Because a missed approach involves two controlling functions, each operating under different sets of assumptions, the sequencing of missed approach traffic back into the structure is often less than problem free.

Along with the controller and pilot landing expectancy, the ATC structure is oriented to the pilot landing out of an approach. A review of FAA's air control manual indicates that all spacing criteria are oriented either to takeoff or to landing. The manual contains little in the way of definitive information regarding the spacing and sequencing of aircraft on missed approaches. Substantiating the premise that the structure is oriented to landing is the practice of assigning arrival controllers to handle aircraft arrivals and departure controllers to handle departures. The missed approach falls somewhere in between; some of the procedure relates to arrival and some to departure. In this regard both controllers must become involved in the missed approach when it occurs and coordination between the two controlling functions is mandatory. Because a missed approach involves two controlling functions, each operating under different sets of assumptions, the sequencing of missed approach traffic back into the structure is often less than problem free.

An example of the type of problems that may occur is the missed approach procedures for the ILS to runway 28R at San Francisco. The missed approach fix is within 3 miles of the centerline of the Point Reyes One Standard Terminal Arrival route. Sequencing missed approach aircraft may require vectoring aircraft out of the arrival route, or the procedure may be completely prohibitive with regard to separation criteria. Another more serious consequence of the landing expectancy of the ATC structure could be the failure to identify conflicting procedures and implement corrective action. In one recent incident, separation procedures were developed and put into use that were unsafe, yet none of the parties involved in the procedure development recognized the unsafe condition, nor did anyone in the review cycle. It took a serious system error to identify the problem.

A LANDING EXPECTANCY INCIDENT

To illustrate how the landing expectancy phenomenon in the overall air traffic system can cause dangerous situations and lead to serious accidents, I will discuss a recent near midair collision incident that occurred this year. This incident involved elements of each of the three types of landing expectancy.

On April 1, 1976 a Hughes Airwest DC-9 and a Northwest Airlines DC-10 almost collided in instrument meteorological conditions over the Spokane International Airport, and came in close proximity to a DC-10 that had just departed the runway. The crew of the DC-9 estimated that the miss distance was about 20 feet. (Crosscheck Nov. '76)

Landing expectancy was exhibited in the following facts of the case:

The DC-9 captain did not follow established company approach procedures and continued

an approach when it was apparent at the outer marker that he would have great difficulty in safely getting the aircraft on the ground from his position. Additionally, although not required to do so, he failed to contact the tower until inside the outer marker on short final.

The separation procedures used by Fairchild RAPCON and Spokane Tower did not provide positive separation between arriving and departing aircraft because too much reliance was placed on a non-mandatory report from the arriving pilot that his aircraft was over the final approach fix inbound to the airport.

The DC-9 captain thought that he was operating in a total radar environment. What he actually was operating with was a radar approach control and a VFR tower.

The Spokane Tower local controller, without knowing the exact position of the DC-9, based his clearance for the DC-10's takeoff on the fact that the DC-9 had not reported at the outer marker. Following the DC-9's report of "inside the marker," the local controller attempted to apply IFR separation criteria on the assumption that the DC-9 would be able to land from the approach.

When informed by the local tower controller of the DC-9's missed approach, the radar approach controller issued the published missed approach procedures and did not recognize the possible traffic conflict.

WHAT IS THE ANSWER?

Recognizing that the phenomenon exists, how do the participants in the ATC system counteract the landing expectancy on a conscious level?

First, for the pilot, there appears to be three things that he can do in this regard.

Become intimately familiar with the missed approach environment. This can be accomplished through situation training in the simulator where missed approach decisions can be practiced under varied conditions and during various parts of the approach profile. He has to learn what he can and can't do in this environment if he is to reduce uncertainty and place landing expectancy in its proper place.

Prepare for the missed approach as well as he does for the approach. This will help reduce much of the uncertainty of go or no go situations. The recent initiation by several air carriers of the sterile cockpit concept should assist in the crew being better prepared for the approach and missed approach because it will provide uninterrupted time for preparation of an approach.

Adhere to established procedures with regard to acceptable approach limits and have many of the decisions regarding missed approaches preplanned. That is, if he should exceed his pre-established limits, he will execute a missed approach. It is important that the other crewmembers adhere to this concept also.

The controller has two defensive actions at his disposal:

Adhere to established clearance criteria and be very cautious of minor deviations.

As the controller clears an aircraft for an approach, he should ask himself: What am I going to do should a missed approach become necessary?

Controlling air traffic structure landing expectancy can only be done through adequate knowledge by each of the participants in the system of how the system works and when potential problems may be expected. To things can be done in this regard:

Pilots and controllers should question procedures that appear in conflict with safe operating practices.

New missed approach procedures should be reviewed to make sure that they do not interfere with established arrival and departure procedures.

In summary, because of the relative infrequency of actual IFR missed approaches and because of the development of this landing expectancy phenomenon that results, three questions should be answered by all participants in the system prior to the initiation of any approach:

Am I, the pilot, as prepared to execute a missed approach as I am to fly the approach?

Am I, the controller, prepared should a missed approach occur?

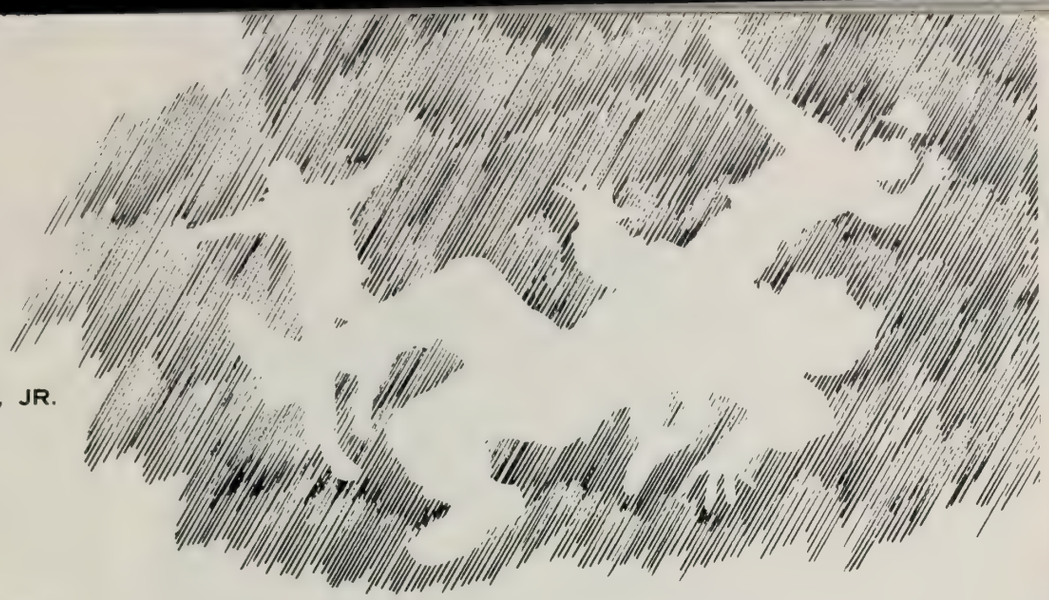
Is the ATC system prepared to handle a missed approach should one occur?

In essence, I have discussed a behavioral phenomenon that can affect the success of an approach and landing. The prudent pilots and controllers, through adequate planning, are able to prevent landing expectancy from adversely affecting their decision making while on final approach, thus improving their own safety as well as the safety of the passengers—Courtesy **Crosscheck** Jan 77. ★

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A LITTLE JOLT'LL DO YA!

LT COL M. W. ALLINDER, JR.
USMC
VMFA-122



Four crews of F-4 Phantoms were preparing for return to MCAS Homebase. The birds were being refueled by truck while one crew was filing the DD-175 for the return flight. During the refueling process, the afternoon sky began to darken with the "duty boomer" moving up from the southwest, obscuring the afternoon sun. The sky was hazy but clear to the north and east—just the normal, usual scattered midsummer afternoon thundershower, right? Ten minutes and six stricken Marines later, the ambulances would arrive to police up after this "usual" isolated thundershower.

The first indications of a storm were the heavy black curtains of rain that began to fall while the weather was 2 or 3 miles from the field. The display of lightning prompted one of the aircrews to secure refueling at once. As the fuel trucks drove away, it appeared that perhaps the storm would skirt the field to the north, and two crews plus their plane captain continued to inspect their birds in preparation for a start and go after the shower passed.

When light rain began to fall, most of the crews ducked under their clean Phantoms. A couple stretched out on the ground. Shortly, the intensity of the rain increased sharply, the wind picked up to about 20 knots, and the water began running under the planes. As a result, everyone had to rock on their haunches to stay dry while marvelling at the small hail that began to pellet the ground. The hail was being blown along by winds now gusting to 35 knots. Base ops was about 200 meters away, so no one wanted to make a dash for it and get wet(ter).

The crack of the lightning wasn't nearby at all; perhaps several hundred meters away. There was no flash, but simultaneously with the report, a lot of things happened. Under one Phantom, one airman was writhing on the ground; one plane captain was prostrate, unmoving and turning black in the face. One airman had his arm curled up in a peculiar contraction. Under a second F-4 one airman and two plane captains were knocked flat. Since no one was touching an aircraft, the lightning had apparently run along the ground, conducted by the rain on the mat, and shocked the Marines. Mouth-to-mouth resuscitation was immediately administered to the two downed Marines, along with sharp pounding on the chest of the immobilized plane captain whose heart had appeared to stop. The two more severely shocked were held by the hospital for 2 days of observation. The other four were examined and released, apparently no worse for wear. The birds were turned up later and had no discrepancies.

Lessons to be learned? None! We "know" that thunderstorms are cranky. We "know" to get in out of the rain, wind, and lightning. We "know" all these things already, don't we? You better believe six wide-eyed, deep breathing Marines know what to do when afternoon thundershowers approach!—Courtesy June 1977 **Approach** magazine. ★

NAME THAT PLANE



This was the first Air Corps attempt to modernize the fighter force to keep up with bomber developments. For answer see inside front cover.



LIBRARY U. OF T. WORTHA - [illegible]

BEWARE

While lifting a truck from an LZ at 60 feet above the ground and 29 kts, the CH-53 yawed and settled back toward the ground. . . .

The aircraft settled into its own disturbed air mass resulting in power settling. . . . (From a recent report.)

Fixed wing aircraft create a downwash as a by-product of lift. Helicopters also produce a downwash, known as induced flow. Although this induced flow is always present around the periphery of the rotor, under certain airflow conditions it can add to the already existing tip vortices causing these vortices to intensify. Coupled with a stall spreading outwards from the root end of the blade, induced flow can result in a sudden loss of lift and a subsequent loss of height. This is a condition known as "settling with power" or "vortex ring." It is somewhat like flying in one's own wake.

The purpose of this paper is not to publish any great new discovery about settling with power, I merely want to remind each helicopter pilot of its conditions, symptoms, development, recovery and most important its prevention.

The conditions in which vortex ring can develop are:

- A combination of low indicated airspeed (below 20 knots), and a high rate of descent (greater than 400 feet per minute).
- A downwind approach.
- Application of power when recovering from a low airspeed autorotation without first increasing airspeed.
- A misjudged and consequently fast approach which requires a flare to be maintained in the final stages

OF VORTEX RING

CAPTAIN JOHN G. TAYLOR III, USAF/RAF Exchange Program

of the descent.

The symptoms of the development of vortex ring are:

- Rudder and stick shake.
- Random yawing.
- Rapid increase in rate of descent.
- Cyclic stick less effective.
- Random rolling and pitching.

Note: Stick shake and random yawing can occur in turbulent conditions on steep approach; therefore, it is essential to cross-check airspeed and rate of descent to distinguish between turbulence and the onset of vortex ring.

We know when vortex ring is likely to occur and what it feels like; now we will look at its development. For hovering, and low rates of descent, the velocity of the induced flow through the disc exceeds the rate of descent itself, and an induced flow pattern similar to that shown in Figure 1 is obtained. In this state all flow through the rotor is downward (relative to the rotor). If collective pitch is reduced to begin a rate of descent sufficient for the rate of descent airflow to equal the rate of induced flow (see figure 2), the airflows at the root of the blades cancel each other, causing the angle of attack of the blades to increase in an attempt to maintain lift. At the tips of the blades the conflicting airflow outside and inside the disc will intensify the tip vortices, further increasing the induced flow.

If the collective pitch is lowered further, the rate of descent will again increase (figure 3); the process will be repeated, and eventually a condition will be reached where the root end of the

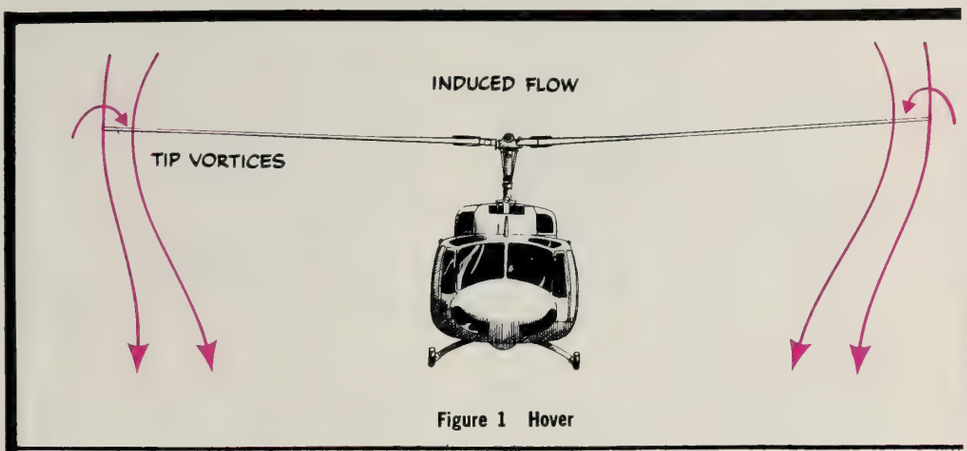


Figure 1 Hover

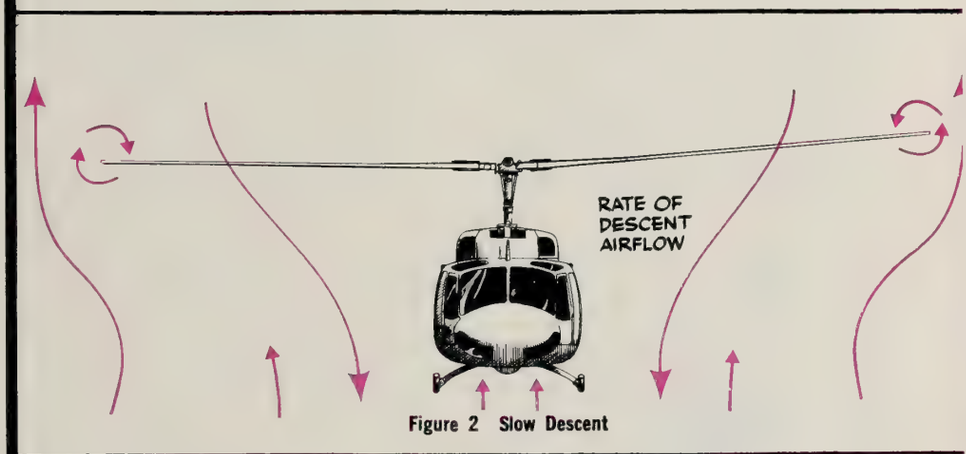


Figure 2 Slow Descent

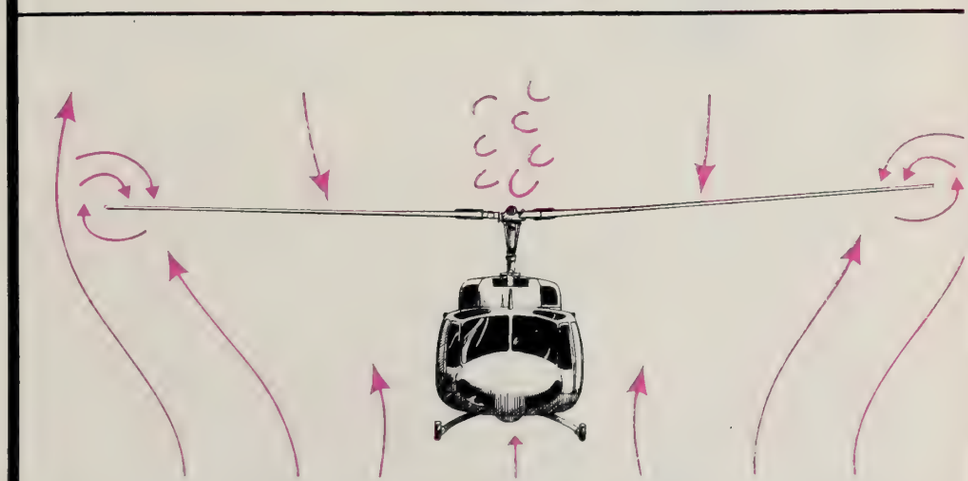


Figure 3 Vortex Ring State

blade will reach its stalling angle of attack. At this stage, lift is decreased both at the tip of the blade, due to the vortices, and at the root of the blade, because of its stalled condition, leaving little area in between to produce the lift necessary to balance the weight. Any further increase in the rate of descent resulting from lowering the lever will further reduce the area of the blade that is effectively producing lift. Once a condition is reached where the lift becomes insufficient to balance the weight, then the rate of descent will rapidly increase, to as high as 6000 fpm[1] on some types of helicopter.

Wind tunnel experiments show that the vortices form and intensify in a most erratic manner, subjecting each blade inboard from the tip to large and sudden variations in angle of attack. Dissymmetry of lift occurs and the helicopter will pitch, roll and yaw to no set pattern, making control extremely difficult. In fully developed vortex ring, raising the collective pitch lever will only aggravate the condition by increasing angle of attack and, instead of slowing the rate of descent, will cause it to increase.

We've seen that raising the lever only aggravates the situation, how then do we recover? To recover from vortex ring it is necessary to change the airflow conditions which are causing it. To recover:

1. Change the disc attitude to achieve forward flight or bank the aircraft, so that the induced flow no longer opposes the rate of descent airflow, and then wait until the airspeed has increased to a safe figure (above 20 kts) before increasing power.

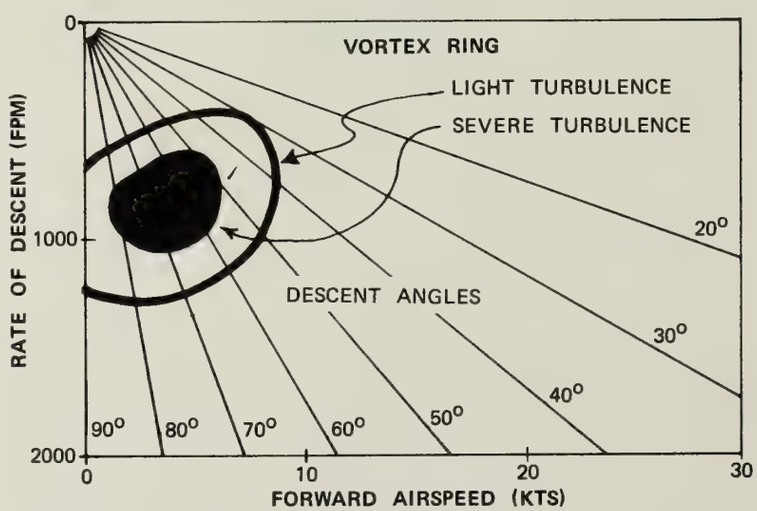
2. Enter autorotation, but it may be impossible to keep the rotor from overspeeding and a full recovery will require a considerable loss of height.

Since a helicopter pilot spends much of his flying time below 1000 feet and recoveries take altitude, we must really concentrate on prevention. Below are listed points which every helicopter pilot should know:

- It is in the low airspeed condition that vortex ring will occur. Ensure, if power is required to arrest any descent or sink, that it is applied before that low airspeed condition is reached (see Figure 4)[2].
- The most likely time for the indicated airspeed to be unexpectedly low is when turning downwind or making a downwind approach.
- Know where the wind is and monitor the airspeed indicator closely when maneuvering at low speed.
- Remember that the onset of vortex ring will be encountered earlier at high gross weights and high density altitudes, because the higher angles of attack required.

In the operational environment and with many other factors to think about, it is unlikely that all these points of aerodynamics will be foremost in our minds. For that reason it is useful to know of them and to consider them from time to time on the ground, so as to retain our instinct for "BEWARENESS" OF VORTEX RING.

Figure 4



NOTE: Several interesting conclusions can be drawn from figure 4. First, the vortex ring state can be avoided by descending on flight paths shallower than about 30° (at any speed). Furthermore, for steeper approaches it can also be avoided at sufficiently slow or sufficiently fast speeds. In both cases the turbulent wake created by the vortex ring is not remaining in the vicinity of the rotor and causing problems. At very shallow descent angles, the wake is shed behind the helicopter. At steep angles, it is below the helicopter at slow rates of descent, and above the helicopter at high rates of descent.

[1] *Royal Air Force Air Publication 3456A*, Principles of Flight, *Part 2, Section 1, Chapter 5.*
[2] *Royal Air Force* Air Clues, *Volume 30, Number 9, September 1976.*

ABOUT THE AUTHOR

Captain Taylor is a graduate of Rutgers University. He was commissioned through Officers' Training School in December 1968 and attended Undergraduate Pilot Training at Craig Air Force Base. He then was assigned to EC-121Ds, and after a year of temporary duty was sent to Rotary Wing Conversion at Fort Rucker. After serving as Chief, Aircrew Standardization for the 40th Aerospace Rescue and Recovery Squadron at Nakhon Phanom Royal Thai Air Force Base, he joined the instructor staff at the Instrument Flight Center. He is presently assigned as a helicopter instructor pilot on exchange with the Royal Air Force at Royal Air Force Shawbury. ★

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XC AND TA

MAJOR JOHN E. RICHARDSON, Directorate of Aerospace Safety

Cross-country flying can be a refreshing change from the routine of local training missions, offering opportunities for a rewarding flying experience. However, a cross-country flight that is not carefully planned can become a frustrating, thoroughly unsatisfactory experience. A large part of this frustration comes about when the expected transient services are not available.

In the past decade we have become spoiled by the excellent service most transient alert people provide. We have come to expect exceptional service, far beyond what is required.

This kind of service was possible as long as manning was adequate, but now with cuts in personnel, everyone has to do more with fewer people. Although commanders are charged with providing transient services, this is an additional responsibility to be accomplished after the primary mission. No commander can be expected to jeopardize his mission merely to provide service to transients.

This doesn't mean that you can't get service. It merely means that some of the extra frills are gone. It means that we will have to take more responsibilities for our own aircraft when we go to a strange field.

One good way to avoid unpleasant surprises at a transient base is to plan ahead. Take a look at the IFR supplement. Look for the information on servicing and availability of transient services. Many bases now have limited transient services outside normal duty hours, and the base may advise transients to expect delays in refueling, etc., during certain periods. For those flying drag chute equipped aircraft, several bases, even with similar aircraft types, will not provide drag chute repack service on weekends or after duty hours.

Once you have checked the IFR supplement and the NOTAMS, you may have some question about services available. Do you want a quick turn? Or maybe you plan to arrive after normal duty hours. If so, call the transient alert supervisor at that base. He can tell you whether the base can handle your needs. It is rather embarrassing to discover after landing at Somewhere AFB that they don't have the proper equipment to service your aircraft. Another bit of planning can help make your trip more enjoyable. Very few TA facilities operate at full strength 24 hours a day. When TA is at minimum manning you should expect delays, so, whenever possible plan to arrive during normal operating hours.

A few comments on eating facilities. The days of elaborate flight line snack bars are numbered. Most places now are exclusively vending machine operations. This means that you will need change and you probably won't be able to get it at Base Ops.

I still fly cross-country regularly, and I find that with a little planning it is a most enjoyable experience. Just remember the responsibility for your aircraft is still yours as long as you are away from home base. Transient services personnel will do all they can to make your stay on their base enjoyable. But they do need your help. By the way, when you go to a base and find the service to be exceptional (good or bad), drop us a line at *Aerospace Safety* magazine. We need the information to help us schedule Rex Riley Transient Services visits. ★

THE INTERNATIONAL

The metric system was conceived in the 16th century in an effort to solve the confusion resulting from the many different methods then used in determining weights and measures. In 1790 the French Academy of Sciences adopted the system, based on the metre as a unit of length and the gram as a unit of mass, as a practical measure to benefit industry and commerce, and as a system suitable for adoption by the entire world. This initial effort has evolved, as more and more units of measure became needed, and as more countries joined the organization, into an International Bureau of Weights and Measures, located near Paris. Also, a General Conference on Weights and Measures (CGPM) has been constituted to handle all international matters concerning the metric system. In 1960, with 36 countries participating, the CGPM gave the modern standard measurement system the title of the International System of Units, for which the abbreviation is "SI" in all languages.

If everyone had gotten together and adopted the same system in 1790 things would be a lot easier for us now. As more items were discovered that needed measuring they could have been incorporated into a standard system. But that did not happen, so the "world" is attempting it now. It will be a long and, in some cases, expensive transition, but well worth the effort because the SI metric system is TEN TIMES easier to use than most of the other systems presently in use.

Situations that tend to confuse the SI usage will exist for some time to come. For instance, the *litre* is a special name widely used for the cubic decimetre. The reason the term litre was not preferred for the SI system is: an early definition of litre was that it equaled the volume occupied by the mass of one kilogram of pure water at its maximum density under normal atmospheric

CONVERTING FROM U.S. CUSTOMARY TO SI METRIC UNITS

MULTIPLY THE U.S. CUSTOMARY UNIT:	BY THE BELOW CONVERSION FACTOR	TO CONVERT TO THE BASIC SI METRIC UNIT: UNIT (SYMBOL)
LENGTH		
INCHES	0.0254	**METRE (m)** ABOUT 3.28 FEET
FEET	0.3048	
YARD	0.9144	
INTERNATIONAL NAUTICAL MILE (6076.115 FEET)	1852.0	
AREA		
SQUARE INCHES	0.000 645 16	**SQUARE METRE (m^2)** ONE SQUARE METRE EQUALS ABOUT 10.76 SQUARE FEET.
SQUARE FEET	0.092 903 04	
SQUARE YARDS	0.836 127 4	
SQUARE MILE (INTERNATIONAL NAUTICAL)	2 589 988.0	
VOLUME/CAPACITY		
FLUID OUNCES (US)	0.000 029 573 53	**CUBIC METRE (m^3)** ONE CUBIC METRE EQUALS ABOUT 264 U.S. GALLONS.
FLUID PINTS (US)	0.000 473 176 5	
FLUID QUARTS (US)	0.000 946 352 9	
FLUID GALLONS (US)	0.003 785 412	
MASS/WEIGHT		
OUNCE (AVOIRDUPOIS)	0.028 349 52	**KILOGRAM (kg)** ONE KILOGRAM EQUALS ABOUT 2.2 POUNDS (AVOIRDUPOIS). DO NOT BE CONFUSED BY THIS ONE! THE PREFIXES ARE ADDED TO THE WORD "GRAM" (g) TO FORM DESIRED MAGNITUDES OF THE GRAM. THE kg IS THE SIZE OF THE PROTOTYPE MODEL MAINTAINED IN PARIS.
POUND (AVOIRDUPOIS)	0.453 592 4	
SHORT TON (2000 POUNDS)	907.184 7	

THE DECIMAL EQUI OF EACH PREFI

1 000 000 000 000
1 000 000 000
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1 000
1
0
0.000
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0.000 000 000 000

CONVERTING FROM THE U.S. CUSTOMARY SYSTEM TO THE SI BASIC VALUES. Multiply the U.S. value by the appropriate conversion factor listed above. Example: .0254 times 6 inches equals .1524 metre.

CONVERTING FROM THE SI BASIC VALUES TO THE U.S. CUSTOMARY SYSTEM. Divide the basic SI value by the appropriate conversion factor. Example: .1524 metre divided by .3048 equals .5 feet.

CONVERTING WITHIN THE SI SYSTEM requires only a shift of the decimal point. However, you may have difficulty, at first, determining how far and in which direction to move the decimal. The information below will show you how easy it is.

DECIMAL DIRECTION: Down — Right, Up — Left. Converting down the prefix scale the decimal is always moved to the *right:* 1 kilometre converts to 1 000 metres. Converting up the prefix scale the decimal is always moved to the *left:* 10 000 metres convert to 10.000 kilometres.

NUMBER OF SPACES THE DECIMAL SHOULD BE MOVED. The "power value" of each prefix will tell you how many spaces the decimal should be moved. Locate "centi" in the above chart. The column to its left shows centi's power value to be 10^{-2}. For our purposes you should **DISREGARD THE 10 AND THE MINUS SIGN.** Thus, centi's power value is 2, micro's is 6, kilo's is 3, etc. (The basic unit, for our purposes, has no power value). The way these power values are used depend on which of the basic units we are working with.

CONVERTING PREFIXES WHEN WORKING WITH BASIC UNITS OF THE GRAM (g), OR METRE (m). *Converting from gram or metre to a prefix value,* you simply move the decimal the number of spaces indicated by the power value of the prefix you are going to. Example: Converting .1524 metre to centimetres (power of 2), you move the decimal 2 spaces to the right (going down the scale), so, .1524 metre becomes 15.24 centimetres, or, .1524 m = 15.24 cm.

Converting from a prefix value to the basic unit of gram or metre move the decimal the number of spaces indicated by the power of the prefix you are going from. Example: Converting 35.16 centimetres (power of 2) to metres, you move the decimal 2 spaces to the left (up the scale), so, 35.16 cm = .3516 m.

NOTE: Prefixes *deka thru exa* form the *upper half* of the scale. Prefixes *deci thru atto* form the *lower half* of the scale.

Converting from a prefix in one half of the scale directly to a prefix in the other half of the scale, add the power values of the prefixes you are working with, then move the decimal that many spaces left or right, depending on whether you are converting up or down the scale. Example: Converting 84 579 micrometres (power of 6) to kilometres (power of 3), you would move the decimal 9 spaces to the left (up the scale), so, 84 579 um = .000 084 479 km.

Converting from one prefix to another on the same half of the prefix scale. You must first find the difference between the powers of the prefixes to determine how far to move the decimal. Example: Converting 567 899 micrometres (power of 6) to centimetres (power of 2), you would move the decimal 4 spaces to the left (up the scale), so, 567 899 um = 56.789 9 cm.

Converting prefixes when working with basic unit of a SQUARE METRE *(m^2).* Multiply all of the power values by 2 and follow procedures for converting grams or metres. Example: Centi now has a power of 4 (and for our converting purposes, the basic unit still has no power value). To convert 6580 square centimetres to square metres, you move the decimal 4 spaces to the left (up the scale), so, 6580 cm^2 = .6580 m^2.

Converting prefixes when working with basic unit of a CUBIC METRE *(m^3).* Multiply all of the power values by 3 and follow procedures for converting grams or metres. Example: 6580 cm^3 = .006 580 m^3.

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STEM OF UNITS (SI)

pressure; however, it was later determined that the litre, so defined, was the equivalent of 1.000028 cubic decimetres. So, even though that definition has been withdrawn (the litre is now defined as the volume occupied by one cubic decimetre), using the term litre in precision measurements might conflict with measurements recorded under the old definition. Thus, *cubic decimetre* was adopted as the proper SI term, even though litre may still be used for the measurement of small amounts of liquids and gases. No prefix other than "milli" should be used with the name litre.

Similar confusion can result from the name *"hectare"* which is often used for an area equal to one square hectometre; it is simply another name for the same value. So if you are looking at the metric system for the first time, why not favor the internationally accepted system, the SI system?

The charts below compare the U.S. customary system with the SI system; this helps to get the initial relation of what term is large and what term is small. The charts then explain how the SI terms apply to each other, which is the most important because the sooner one is able to think in metrics, the easier it is.

We are, obviously, only scratching the surface. If you desire more complete information on the SI system the ASTM Standard Metric Practice, ANSI/ASTM E 380-76, IEEE STD 268-1976, which has been approved for use by agencies of the Department of Defense, may be ordered ($4.00) from:

American Society for Testing & Materials
1916 Race Street
Philadelphia, PA 19103
U.S.A.

"POWER VALUE," OR EXPONENTIAL EXPRESSION OF EACH PREFIX.

"PREFIX SCALE" TO KEEP FROM HAVING TO WRITE LONG DIGIT NUMBERS YOU CAN PUT ONE OF THESE PREFIXES IN FRONT OF THE BASIC UNIT'

	PREFIX	SYMBOL	PRONUNCIATION (USA) *
10^{18}	exa	E	EX' A (*A* AS IN *A*BOUT)
10^{15}	peta	P	PET' A (*E* AS IN P*E*T, *A* AS IN *A*BOUT)
10^{12}	tera	T	AS IN *TERR*ACE
10^{9}	giga	G	JIG' A (*I* AS IN J*I*G, *A* AS IN *A*BOUT)
10^{6}	mega	M	AS IN *MEGA*PHONE
10^{3}	kilo	k	KILL' OH
10^{2}	hecto	h	HECK' TOE
10^{1}	deka	da	DECK' A (*A* AS IN *A*BOUT)

nit of: metre, square metre, cubic metre, or gram)

10^{-1}	deci	d	AS IN *DECI*MAL
10^{-2}	centi	c	AS IN *CENTI*PEDE
10^{-3}	milli	m	AS IN *MILI*TARY
10^{-6}	micro	μ	AS IN *MICRO*PHONE
10^{-9}	nano	n	NAN' OH (*AN* AS IN *ANT*)
10^{-12}	pico	p	PEEK' OH
10^{-15}	femto	f	FEM' TOE (*FEM* AS IN *FEM*INE)
10^{-18}	atto	a	AS IN AN*ATO*MY

The first syllable of every prefix is accented to assure that the prefix will retain its identity. Therefore, the preferred pronunciation of kilometre places the accent on the first syllable, not the second . . . kill' oh meter.

TEMPERATURE CONVERSION

(Degrees Celsius x 1.8) + 32 = Degrees Fahrenheit (^{o}F)

(Degrees Fahrenheit − 32) ÷ 1.8 = Degrees Celsius (^{o}C)

NOTE: The SI unit of temperature is the kelvin (K), however, the Celsius scale (formerly called centigrade) is also acceptable.

SIMPLIFIES PRICE COMPARISONS

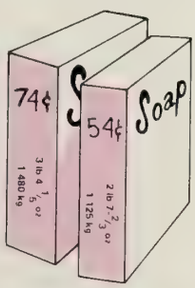
To compare unit price of 3-lb 4-1/5 oz Giant size at 74c with 2-lb 7-2/3 oz Large size at 54c convert weight to ounces and divide into selling price:

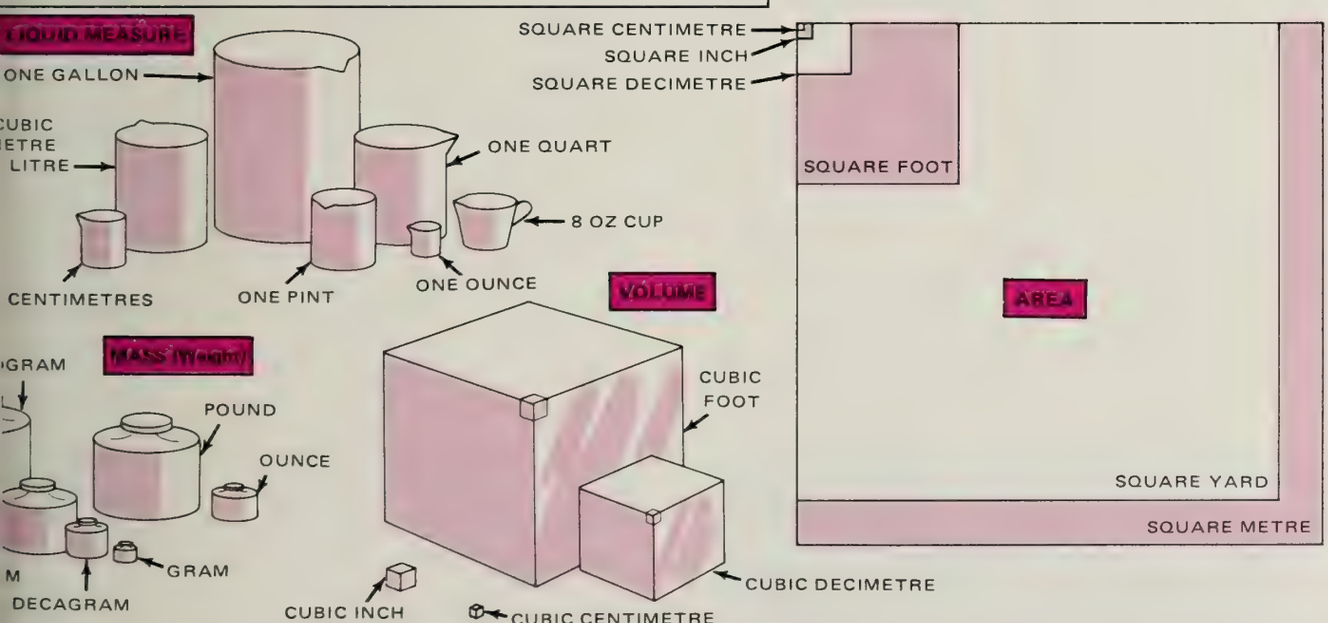
EXAMPLE:

3-lb 4-1/5 oz = 52.20 oz
74c/52.20 oz = $.0142 per oz
2-lb 7-2/3 oz = 39.67 oz
54c/39.67 oz = $.0136 per oz

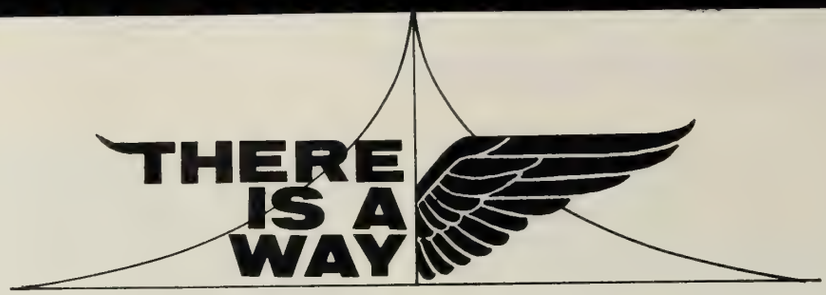
this indicates the smaller package is the better buy.

By using the metric system we eliminate conversions, thus:
74c/1.480 kg = 50c per kg and 54c/1.125 kg = 48c per kg.





REPRINTED COURTESY OF NORTHROP F-5 TECHNICAL DIGEST



Annually the Air Force recognizes a given number of individuals, units and commands for outstanding performance. However, competition is keen and not all win major awards. To recognize all of those, AEROSPACE SAFETY is featuring one or more in each edition. In this way we can all share in recognizing their fine performance and, perhaps, learn some valuable lessons.

Nominated For The Koren Kolligian, Jr., Trophy

Captain Jeno M. Bean
500th Tactical Fighter Training Squadron

Lt Col Frederick E. Tokash
58th Tactical Training Squadron

Luke Air Force Base, Arizona

On 2 September 1976, Captain Bean, instructor pilot, and Lieutenant Colonel Tokash, instructor weapon systems officer, were leading a flight of four F-4Cs on a student air-refueling/ground attack night mission when their F-4C experienced utility hydraulic failure. They declared an emergency and, with the number two aircraft as a chase, proceeded to Luke Air Force Base, Arizona, for recovery. When the landing gear would not extend with the normal system, they ran the emergency gear lowering checklist. The nose gear indicated down and locked, while the main gear remained up. This condition was confirmed by the chase aircraft. Colonel Tokash tried the emergency gear lowering procedures without results. The aircrew contacted the Supervisor of Flying and advised him of their situation. After considering all possible alternatives, they proceeded to the authorized jettison area to jettison their armament and SUU-25 flare dispenser with live flares, and requested foaming of the runway. They then proceeded to the fuel burn-out area to further reduce their gross weight and to apply positive and negative G forces to the aircraft in an attempt to allow the main gear to free fall to the down position. All attempts to get the main gear down were unsuccessful, so the aircrew was advised to prepare for a straight-in approach-end barrier engagement on the foamed runway. Upon being advised that the runway had been foamed, the aircrew attempted to lower flaps, in an attempt to slow final approach speed. When the flaps would not lower using normal procedure, the emergency flap lowering checklist was referred to and followed. At this time, the flaps indicated that the trailing portion was still up, and the leading edge in "transient." The emergency system was attempted from the rear cockpit with no further movement noted. The chase aircraft confirmed that the trailing edge flaps were up, but could not confirm the position of the leading edge flaps due to darkness. Even though the approach and landing were complicated by darkness, an inoperative landing light, and a split-flap condition, the aircrew executed a perfect landing on the nose gear and outboard external fuel tanks and made a successful barrier engagement. Because of a depleted pneumatic system, Captain Bean and Colonel Tokash had to manually open the canopies and hold them open as they egressed the aircraft. Jettisoning of the canopies was ruled out to preclude a possible fire due to the existence of fuel vapors from the ruptured external fuel tanks.

The professional skill, knowledge, and exceptional calmness exhibited by this aircrew under these extreme adverse conditions resulted in the safe recovery of a valuable Air Force aircraft. ★

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NEWS FOR CREWS

Information and tips to help your career from the folks at Air Force Military Personnel Center, Randolph AFB, TX.

CAPTAIN THOMAS I. PARKS, AFMPC

DEPARTMENTAL/JOINT RATED ASSIGNMENTS

To those rated officers seeking responsible positions in high level policy drafting and decision making activities, MPC's Rated Departmental/Joint Career Management Section may have a challenging job for you. This office is charged with providing outstanding pilot and navigator manning support to those activities of critical importance to the Air Force and the Department of Defense. Departmental and Joint manning activities exist throughout the defense establishment including: Air Force positions above MAJCOM level as well as joint, combined, allied, and Secretary of Defense staff billets. Chapter 9 of AFR 36-20 (the officer assignment reg) provides a list of these activities which include among others the Air Staff, White House, JCS, Readiness Command, NATO, and the MAAG and Mil Groups.

The sensitive mission and far reaching impact of these activities warrant specialized manning consideration. Grade levels utilized by the various agencies include senior captain through lieutenant colonel (with full colonels' assignments, of course, being managed by the Colonels' Group at the Pentagon). Vacancies occur worldwide. Typically, these type positions become vacant due to an officer's completion of a controlled tour, promotion to colonel or reassignment to higher levels. Requirements exist for officers from all rated backgrounds. And to do our job we constantly seek generalists with strong operational and staff credentials, as well as rated officers possessing experience or education in specialized areas such as operations research, computers, and research and development. Strong writing and briefing skills are universally requested by using agencies.

Now we come to the specifics of how individual rated officers are identified to fill a Departmental/Joint requirement. First, all rated officers moving through the assignment cycle at AFMPC are screened for possible placement in this arena. Many officers are identified when they are on the move as a result of a DEROS, stabilized tour completion, or graduation from intermediate or senior service school. If a requirement exists which cannot be filled from among officers in the "available" cycle, computer supported searches are undertaken to identify an officer meeting the qualifications. After a careful review of the officer's entire record, the Departmental/Joint Career Management Team selects the individual for nomination and/or assignment against a specific requirement.

Many of the same factors influencing a normal assignment of a rated officer are considered in making a Departmental/Joint assignment. An individual's personal desires, rated expertise, and "gate" status all get considered. Volunteers are certainly preferred, and a Form 90 indication of a desire to perform duty in the Departmental/Joint arena could well result in the most challenging job of your career. However, overall duty performance is the key to progressing into these high-impact positions. Top performers create demands for themselves by building strong records as aircrew members starting at the flying unit level. Professional military education appropriate with grade may help. Advanced education, and some demonstration of ability to handle higher level duty could be influential. However, basic duty performance is still the most important criterion. As advocated by AFMPC resource managers, "Perform well in your present job," is sound advice for the serious, professional military officer.

Overall, Departmental/Joint positions offer a high-visibility, challenging environment, loaded with difficult yet rewarding opportunities. Awaiting those officers with a demonstrated superior performance capability are virtually unlimited personal and professional growth avenues of highest impact to the USAF and the nation. ★

ABOUT THE AUTHOR

Captain Parks is assigned to AFMPC Rated Officer Assignments completing a one year ASTRA assignment. His flying background includes tours to SEA and RAF Woodbridge, England, in HC-130's. He is a graduate of Virginia Tech with a degree in Geology. Captain Parks' next assignment will be with the MAC staff at Scott AFB, Illinois.

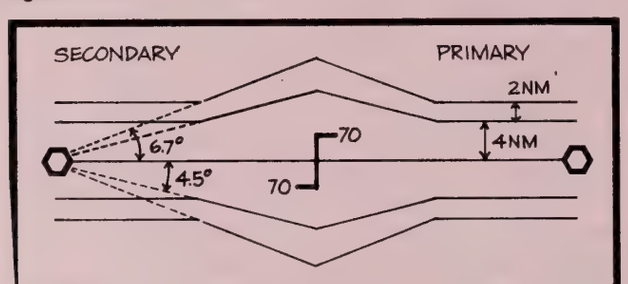
USAF IFC APPROACH

AIRWAYS

Q: How wide is an airway?

A: An airway's primary protected airspace has a minimum width of 8 NM; 4 NM either side of centerline. This area begins to expand at a rate of 4.5 degrees either side of the primary width when the changeover point exceeds 51 NM from either facility as shown in Figure 1. In addition to this primary airspace, an additional 2 NM either side of the airway is provided for a secondary zone. This area expands at a 6.7-degree angle from the secondary width when the changeover point exceeds 51 NM. If the changeover point is other than halfway between the navigation facilities, it will be depicted on the enroute chart by (). Since the equipment can be up to 4.5 degrees in error and still be within tolerance, make every effort to remain as close to the centerline of the airway, as possible.

Figure 1



Q: How wide is a jet route?

A: Just as an airway, a jet route is formed by a straight line, whenever possible, between NAVAIDS, yet has no specified width. Since the primary reason an airway has a specified width is obstruction clearance and since the highest mountain in the United States, except Alaska, is 14,495 feet, a width specification is not necessary for jet routes. A few jet routes in Alaska do have a specified width due to their proximity to terrain in excess of 18,000 feet. Also, as with airways, pilots should attempt to remain as close to centerline as possible.

USE OF THE MILITARY AVIATION NOTICE (MAN)

Q: When should the bound, United States Low Altitude Instrument Approach Procedure (IAP) MAN be used?

A: When using a Low Altitude IAP booklet, first check the cover of the particular volume you intend to use for the effective date of the MAN. On the MAN itself, in addition to the effective date, there will be a "TO" date. For example, if the "TO" date is 19 November 1977, the MAN will be effective through midnight (local time), 18 November 1977.

Q: When the Low Altitude IAP MAN is in effect, how should it be used?

A: The MAN should be referred to before the IAP booklet. When using the MAN, it is imperative that you first refer to the Table of Contents for any changes to the aerodrome of intended use. The Table of Contents will identify approaches that have been added, deleted, or replaced, including effective dates if they are different from the MAN publication date. In other words, flipping through the MAN looking for approaches to a particular aerodrome is not assurance that an approach is still current. That information can only be found in the Table of Contents.

FILING TO INITIAL APPROACH FIXES

Q: Can I use the high altitude structure for the enroute phase and a low altitude IAP for the terminal phase of a flight plan? Conversely, can I use the low altitude structure for the enroute phase and a high altitude IAP for the terminal phase?

A: Yes. It is acceptable to list an Initial Approach Fix (IAF) at your destination in an altitude structure other than the one you've planned to use for the enroute phase of your flight. As you approach your destination, if you plan to fly a published approach, request any necessary altitude changes from the controlling agency. If a radio failure should occur during operation off published IFR routing enroute to the IAF, the applicable minimum safe/emergency safe altitude or last assigned altitude, whichever is highest, should be adhered to until established on a segment of the instrument approach procedure or published IFR routing. If lost communications occurs at an enroute altitude of 9,000 feet, for example, and the planned instrument approach begins at a minimum altitude of 15,000 feet as in the HI-TACAN/ILS RWY 35, Altus AFB, figure two, next page, the pilot should follow the procedures outlined in the IFR Supplement and remain at 9,000 feet. Since the minimum/emergency safe alti-

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By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

Figure 2

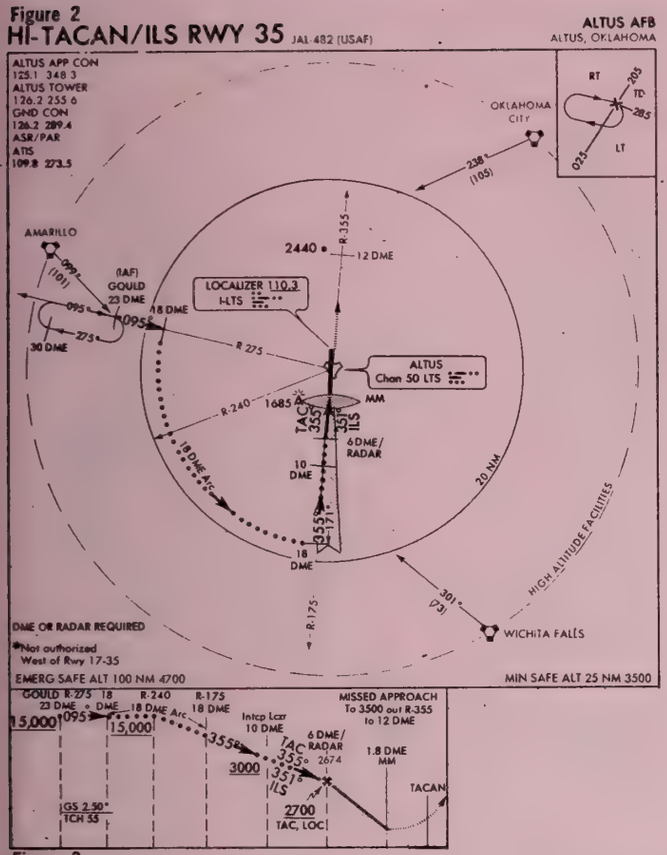
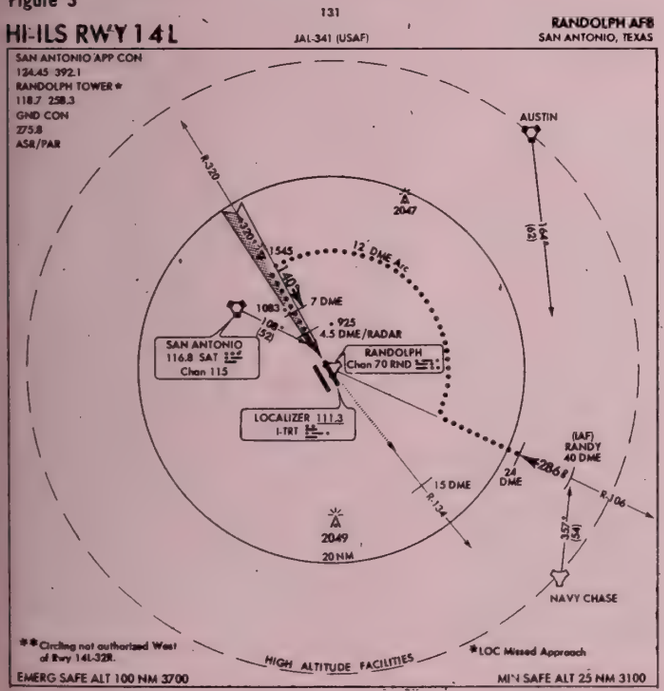


Figure 3

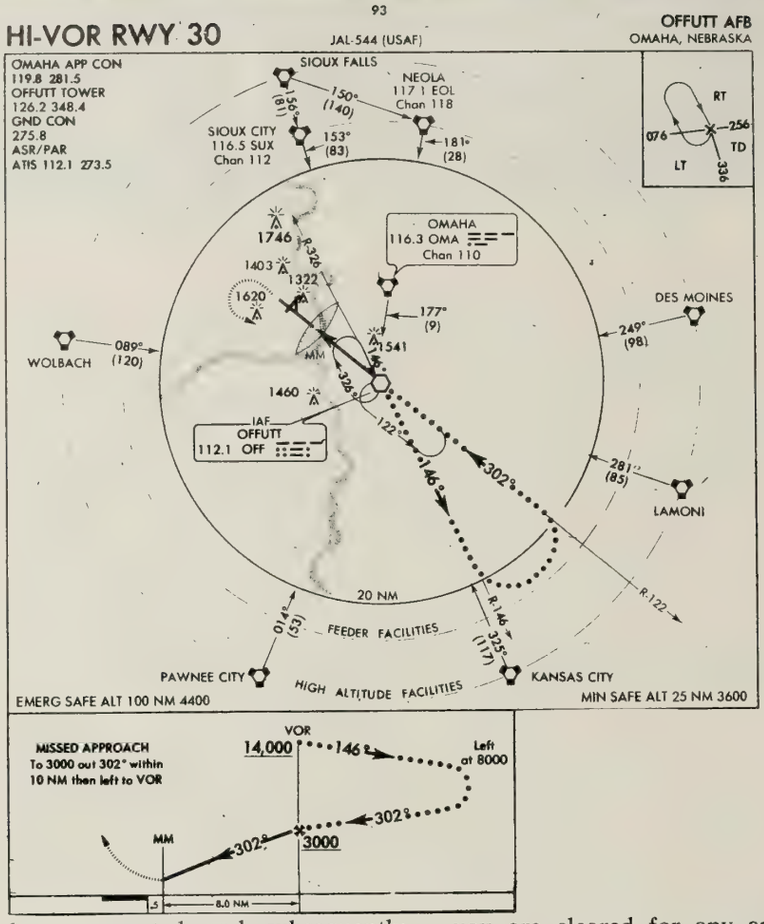


tude is not higher, he should execute the approach from that altitude.

No particular problem exists for the pilot operating in the jet route structure enroute to a low altitude IAF as long as the IAF is formed by an (H) class facility, or an (L), or (T) class facility which is published for high altitude use. An example of such a facility is the Randolph TACAN, figure 3.

This NAVAID is an (L) class facility, yet is published in association with a high altitude approach procedure. In order to provide the optimum margin of safety, use the class of facility with the greatest normally anticipated interference-free service area, whenever possible. If unsure of the capabilities of the facility in use and no other options are available, the pilot should use his own good judgment as to whether or not he is receiving the NAVAID satisfactorily. In any case, radio out, at the ETA, or EAC if one has been received, the pilot is cleared to descend in a charted holding pattern or in a holding pattern on the side of the final approach course to the fix on which the procedure turn is prescribed, and execute the approach.

Another problem which may be encountered when you have filed from the low altitude enroute structure to a high altitude IAP is that of flying an IAP with a non-DME teardrop penetration. In this situation, you should perform a level fly-off from the IAP for 15 seconds for each 1,000 feet the aircraft is below the recommended/minimum altitude as shown at the IAF. For example, assume you are enroute to the Offutt VOR at an assigned altitude of 10,000 feet and



have requested and subsequently been cleared by ATC to fly the HI-VOR RWY 30 approach to Offutt AFB (as shown in Figure 4).

Upon arrival at the IAF you should perform the fly-off for one minute; e.g., minimum altitude (14,000 ft) minus assigned/actual altitude (10,000 ft) equals (4,000 ft) altitude difference times 15 seconds/1000 ft equals one minute. This fly-off will assure you of enough distance inbound to descend to the FAF altitude prior to reaching the FAF.

If the weather permits, the best solution to lost communications problems is to maintain Visual Meteorological Conditions and land. Remember, if you plan to arrive at the IAF from a facility not shown on the approach chart, you should plan to keep your route of flight within the service volume area of the navigation facilities used. Also, be aware that, for Air Traffic Control purposes, at the ETA or EAC, you are cleared for any approach to that airfield of intended landing from any IAF and are not restricted to the IAF filed in the flight plan.

POINTS TO PONDER

MODE C

Have you ever been directed by ATC to "STOP MODE C SQUAWK?" If so, have you wondered why ATC wanted you to turn off your Mode C?

The reason you were instructed to "STOP MODE C SQUAWK" was probably because of a difference of more than 300 feet between the altitude you reported to ATC and the altitude which ATC displayed on their radar. How does the radar controller know at what altitude you are? Very simple. Your altitude encoder (Mode C) aboard the aircraft generates a signal from an internal altimeter permanently set to 29.92. This signal is transmitted in 100-foot increments. The ATC computer receives and then translates this signal into a numeric readout on the controller's radar scope.

Now, back to the 300-foot altitude difference. When the controller notes this difference, he normally assumes an airborne equipment malfunction. First, he will request that you verify your altimeter setting by stating, "SAY YOUR ALTIMETER SETTING." If the altimeter setting you read back is incorrect, he will issue the correct altimeter setting and request you confirm your altitude. If the 300-foot altitude discrepancy still exists, he will instruct you to turn MODE C off by stating, "STOP ALTITUDE SQUAWK, ALTITUDE DIFFERS (number of feet) FEET."

MINIMUM SAFE ALTITUDE WARNING (MSAW)

Recognizing a need to assist the air traffic controller in his efforts to detect aircraft that are within, or are approaching, unsafe proximity to terrain/obstructions, the FAA has developed and is implementing at all Automated Radar Terminal System (ARTS III) facilities, a new computer function called "Minimum Safe Altitude Warning (MSAW)." The MSAW function will generate an alert to the controller when a tracked, Mode C-equipped aircraft being processed by MSAW is at, or is predicted by the computer to go below, a predetermined minimum safe altitude. Controllers will evaluate each alert that is generated, and, when appropriate, will issue a radar safety advisory to the aircraft by stating, "Low Altitude Alert. Check your altitude immediately."

IFR aircraft with an operating altitude encoding transponder will automatically be processed by the MSAW function when it is operating. VFR aircraft with an operating altitude encoding transponder will will be provided MSAW processing upon pilot request. It is expected that all ARTS III terminal facilities will be equipped with the MSAW function by late 1977. ★

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What Ever Happened To... HANGAR FLYING?

CAN SOCRATES OFFER A NEW WAY TO SHARPEN FLIGHT CREWS?



MAJOR JOHN D. WOODRUFF
Directorate of Aerospace Safety

I'm sure most of you have participated in B.S. sessions around the squadron, discussing flying procedures and systems analysis. (You were hangar flying and didn't even know it.) Some of you may have even been involved in a formalized hangar flying program. I was a member of a tactical airlift squadron that had such a program. The problem was, it only functioned for copilots prior to unit rotations overseas and concentrated mainly on ICAO procedures. *So, I ask you, what ever happened to hangar flying?*

With smaller defense budgets, reduced flying time, crowded flight simulators, and the "Feet on the Ramp" program, why can't we make more efficient use of hangar flying instruction to ensure a more adequate understanding of our systems and procedures? Instructor pilots sometimes mistake memorization of procedures for learning, and that's an easy mistake to make with the limited time available and the heavy student load. If the student rattles off procedure, without hesitation, it is easy to assume he understands the procedure thoroughly. Of course, you have never made that mistake! Right? Right!

To increase our effectiveness

What Ever Happened To Hangar Flying?

continued



as instructors and support this ultimate goal of understanding, I propose you consider a formal hangar flying program in your squadron, and try the inquiry method of instruction. (That's a fancy name for the "What would you do if" . . . games you've been playing all along and didn't even know it.) It doesn't have to be an elaborate program with special facilities; just set aside a couple of hours one afternoon a week, plan a problem or two, get those copilots, AC upgrades, and less experienced pilots in there, and see what happens.

Historically, the concept of the inquiry method goes back to Socrates (no he didn't pull the chocks at Kitty Hawk!) and has been called the Socratic method, the inductive method, and the discovery method. It makes no difference what you call it, so we'll call it the inquiry method. Just to get our compasses straight, check any dictionary and you'll find the main difference between learning and memorization lies in the concept of comprehension. Comprehension is the key that unlocks the door to understanding.

To solve this problem of understanding with the inquiry method, the instructor's attitude is most important. His beliefs, feelings, and assumptions will determine the quality of instruction. Neil Postman and Charles Weingartner in their book, *Teaching As A Subversive Activity,* see the following attitudes as important for the inquiry instructor:

- He rarely tells students what he thinks they ought to know.
- His basic mode of discourse with students is questioning.
- Generally, he does not accept a single statement as an answer to a question.
- He encourages student-student interaction as opposed to student-teacher interaction.
- He rarely summarizes the positions taken by students on the learnings that occur.
- His lessons develop from the responses of the students.
- Generally, each lesson poses a problem for students.
- He measures his success in terms of behavioral changes.

These atitudes are important because they set the "atmosphere" of the learning environment.

METHODOLOGY

In addition, the employment of these attitudes is equally important. Here is an example of how the inquiry method can be used in a hangar flying program through a scenario developed about a C-130 "Herky Bird."

THE SITUATION

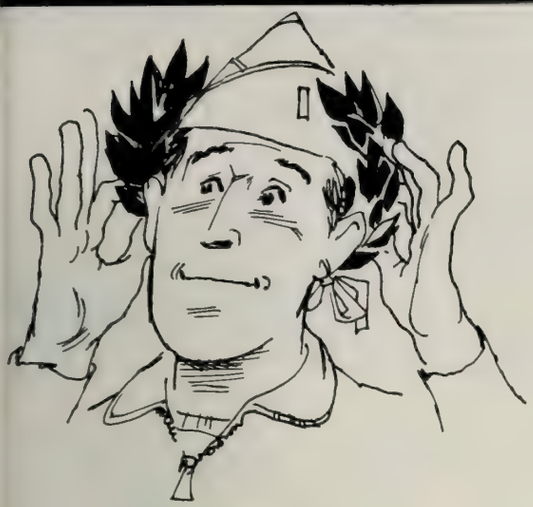
- Location: Just past the equal time point between the Eastern Coast of the US and the Azores.
- Altitude: 23 thousand feet.
- Crew: Basic crew of five.
- Cargo and passengers: 17 thousand pounds palletized and 10 passengers.
- Fuel load: 32 thousand pounds.
- Weather at destination (Azores): 300 broken, 2000 overcast, one mile visibility with rain showers, winds 270 degrees at 30 knots, altimeter 29.82.

The Problem ("Each of his lessons poses a problem"): A loud singing sound in the props.

Questions for the Students ("His basic mode of discourse with students is questioning").

- How immediate is the problem?
- How do you logically determine which prop it is?
- How do we use our basic procedures to solve the problem? (Explain each action you take.)
- How will you proceed if none of the corrective procedures solve the problem? (Explain why.)
- How will the loss of the engine affect other flight systems?
- How will the loss of the engine affect your maintaining altitude?
- How would the loss of the

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engine affect the continuation of the flight all the way to landing at destination?

- How does your aircraft gross weight and fuel load fit into the problem?
- How do physiological factors affect this problem?
- How would the loss of a second engine affect the flight?
- How does the weather at destination affect your planning?
- How does the experience level of the crew affect your planning?
- How does your attitude and the way you handle yourself affect overall crew performance in this situation?
- And last but not least, how does the command and control system fit into your problem?

INSTRUCTIONAL TIPS

As a result of this scenario, notice how most of the possible actions to be considered were set up through a series of questions. Remember, these questions only set the stage for the problem. The instructor will surface additional questions as they develop from the responses of the students. As you can see, the responses of the students will allow the instructor to formulate additional questions and carry them to the depth required by the problem.

One technique is for the instructor to challenge student responses by redirecting one student's question to another student in a different form. The instructor should be sure the order of his questions leads the students through a logical sequence. Remember not to start the questions with the word "what," because it might evoke a single answer to the question. Single answers have a tendency to close the discussion. The instructor should ensure all his questions are formed to create a relationship between actions; that is, they force the students to think about procedures in terms of sequences and variables. Additionally, the instructor should ensure questions are "pluralizing" in that they ask for reasons and causes.

He should bring in other students with his questions from responses to develop crew coordination through student-student interaction and clarify standards by comparing other students' judgments. He should encourage students to modify their positions when new data demands a change due to new variables in the situation. Finally, the instructor should attempt to sharpen student's skills in classifying through establishing priorities.

THE "WHY" INVOLVED

As you can see, the inquiry method of instructing supports the all important goal of the instructor: *Understanding*. The instructor cannot be satisfied with the memorization or demonstration of a procedure. He has the ultimate responsibility of assuring that his students have a thorough understanding of the "why" involved. In some situations and with some systems, this "why" might prevent an accident and save numerous lives. The inquiry method will stave off tendencies toward memorization and will emphasize the learning of relationships among objects, systems, events, people, conditions, and feelings.

TRY IT; YOU MIGHT LIKE IT

A formal hangar flying program centered on the understanding of systems and procedures might just be the supplement to your training program that you've been looking for. Try it and see if your daily training efforts and checkrides improve. (Remember, "your success will be measured in terms of behavioral changes.") You instructor pilots can use it to emphasize those problem areas that show up on the monthly Stand/Eval trends. Safety officers can use it in a teaching interview at the next monthly flying safety meeting. Most importantly, don't sell hangar flying short as a part of your overall program of training and safety instruction. ★



Hide And Go Seek

SGT HERBERT A. KUEKER
Operations and Requirements Branch
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Since the conclusion of hostilities in SEA, I'm sure the thought of what living in the Hanoi Hilton was like has crossed all of our minds. Most of us in the Air Force don't really have to worry about ever being captured —I sure don't. On the other hand, there are a lot of airplane drivers who don't relish the possibility of someday ejecting. I know that isn't a very nice thought, but it's a fact of air warfare. Airplanes get shot down, and crew members have to eject; sometimes smartly into enemy-held country.

That doesn't necessarily mean immediate capture and imprisonment. All of us, as military members, have a moral guide which we live by, part of which says "I will never surrender of my own free will." So, when your number tens smack the earth, you have that obligation to hightail it out of there. To successfully accomplish that mission, you're going to have to evade both the enemy soldier and the civilian population. Evasion techniques are quite simple, but applying them successfully can be a very difficult problem which requires patience, planning, and attention to detail.

In most cases, you will have a few moments to think and to get your act together as you come down in the parachute. This time can be used for a lot of things. It provides you with an excellent vantage point for observing enemy activity, active enemy installations, local population areas, roads, waterways, and the general scope of the terrain. **Use** this vantage point to your benefit by evaluating the situation and planning your direction of travel. This information could also come in handy if there is a need for you to act as a forward air controller and vector in air strikes.

Almost all crew members will feel like they have 100 pounds of equipment on their backs when they hit the ground. You really don't have that much, but what you do possess could prove to be invaluable to you as a survivor/evader. Unfortunately, in an evasion situation, you may have to move much too fast to carry all of that equipment, let alone have time to pack it into a bundle one can carry. So you say, "What should I do with the equipment?" That depends on your physical condition, the terrain, the weather, and the usefulness of each piece



Before you move out, use the brown and green gores of the parachute canop to bundle everything you're leaving an throw it in some thick brush or unde some leaves or rocks.

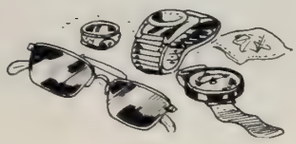
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of equipment at the time. For example, if your leg is broken, you surely won't be able to carry bulky items like a full parachute and harness, or a life raft. If the enemy is hot on your tail, you might not want to take any of the equipment except the radio.

Should you come down in a cold area, you might decide you want to keep the green and brown gores of the parachute canopy for the construction of a shelter or sleeping bag. If the enemy is present, the white gores would provide good camouflage in a snow-covered environment.

Your next logical question would be, "What should I do with the excess equipment?" Bury it, cover it, burn it, eat it, or leave it! One thing you never want to do as an evader is to decide you are carrying too much and start leaving a trail of excess equipment through the woods. If you take it with you, it must **stay** with you. If you start chucking it out on the trail, you might just as well put out road-signs as to which way you are going. So before you move out, use the brown and green gores of the canopy to bundle everything you are leaving and throw it in some thick brush, or under some leaves or rocks. Even if it only takes the enemy 10 minutes to find your discarded equipment, that's 10 minutes head start you have provided for yourself.

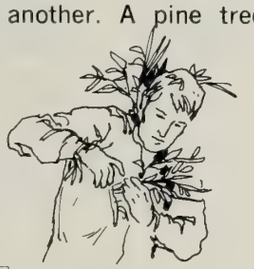
Obviously, in some areas of the world, a 6 foot 6 inch John Wayne-type looks a little out of place. So up pops your next problem: "How do I camouflage myself to look like a rice plant?" Well, you can't, but you surey can apply some basic camouflage techniques and blend in with the background. Sanitize your uniform by removing all rank, insignia, patches, etc. Also, be sure that your under-



Don't forget the watch, rings or eyeglasses; any shiny object can give you away.

wear is tucked in and not showing white. Tee shirts under an open collar are dead giveaways.

Don't forget the watch, rings, or eyeglasses; any shiny object can give you away. Next, darken your skin with mud, grease, ashes, or a camouflage stick so that the oils in your skin won't glisten in the sun or moonlight. Be sure to break up the body outline by using pieces of foliage indigenous to the area. Place it so it is sticking out of your pockets, trousers, boots, hat or wherever you can. Also, please remember to change it as you move from one type of foliage into another. A pine tree looks



Be sure to break up the body outline by using pieces of foliage indiginous to the area.

awfully funny sneaking across a wheat field!

Now that you have your equipment sorted and your body camouflaged, the next problem concerns travel. There are three things to remember about evasion travel: When to, how to, and where to.

In the pre-mission briefing you should have been given guidelines to follow if the necessity to travel on foot arises. If those guidelines aren't applicable, there are others to follow. Only travel if you have a place to go, because wandering around aimlessly in the boonies will be very tiring and unproductive. Besides, it generaly isn't smart to travel deeper into enemy territory.

You should also keep in mind that the rescue forces may direct you to travel to a more suitable pick up area. How to travel is a little more difficult. In mountainous areas with cover available, it is best to travel on or near the military crest of a hill. That is two-thirds to three-fourths of the way up the hillside. This gives you both an excellent vantage point and good concealment. Additional-



It is best to travel on or near the "military crest" of a hill. That is two-thirds to three-fourths of the way up the hillside.

ly, there are very few people or trails for you to encounter up there. Try to keep your travel posture as low and slow as possible, to make it more difficult for an enemy observer to spot you. You must remember to circumnavigate all trails, roadways, waterways, open areas, and populated areas.

The decision as to when to travel, at night or during daylight

Hide And Go Seek continued



The decision as to when to travel, at night or during daylight hours will be dictated by situation and terrain. Traveling at night is generally recommended—

hours, will be dictated by the situation and terrain. Traveling at night is generally recommended, but the environment may prohibit movement after dark. In that case, you'll have to travel in daylight, so pick the time of day with the least likelihood of contact with people. Careful observation will be your best insurance.

In an extended evasion environment, none of us can travel forever. You've got to stop and rest somewhere, at some time. The needs for a shelter or camp site are quite elementary. The primary one, naturally, is concealment. Remember that the enemy can see you not only from the ground, but from the air as well, so you must camouflage any shelter well from all angles. The word BLISS is a good key word when dealing with an evasion shelter or campsite. The B represents **blending** with the surrounding area. The L means **low silhouette.** The I, for **irregular** shape and contour, and the S for **small** in size and S for **secluded** area. Remember the BLISS formula; it could save your life.

One of the most dangerous acts you have to do in an evasion environment is to procure food and water. Water is an absolute necessity, but food really isn't for the first few days. So unless you feel



Remember that the enemy can see you not only from the ground, but from the air as well, so you must camouflage any shelter well from all angles.

your physical condition is deteriorated to the point where food is a necessity, don't try to E&E up into a farmer's yard and kill his prize cow. Stay concealed and capture small rodents, squirrels, fish, etc., that won't be missed.

Water is a necessity, but it, too, can be very dangerous to get. People frequent water holes, rivers, creeks, and lakes, so it's very easy to get captured there. If at all possible, get your water



Water is a necessity, but it, too, can be dangerous to get.

from swamps, intermittent drainages, water vines, trees, the dew on plants, or from rain water before trying to sneak up to the town well. If you should have to resort to a common water site, scope it out first and find out at what time of day you're least likely to encounter hostile forces.

These are by no means all of the known tricks for evasion. There are many military booklets on the subject that are well worth reading. What I have done is give you a few basic items which could help you be better prepared for evasion, and maybe keep you from making a simple blunder which could lead to your capture.

Questions or comments concerning the information contained in this article should be directed to 3636 CCTW/DOTO, Fairchild AFB WA 99011, or AUTOVON 352-5470. ★

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OPS TOPICS

TRANSIENT SERVICES

Have you ever had difficulty with transient services on a base? Did you fill out a transient services questionnaire? This piece of paper is one of the best vehicles you have to get the attention of those people on base who can fix the problem. That is, they can fix it if you give them the information. When you make a complaint about some facility or service, give as much information as possible. Include dates, times, persons contacted, or frequencies. Anything that will help pinpoint the difficulty. Describe your problem as completely as possible. Finally, give a name and phone number so that the supervisor in charge can contact you for more information if necessary.

All too often we receive calls from people at bases complaining that they cannot correct a transient services problem which they cannot define. The pilot involved made a vague complaint and then left no name or phone number.

Most base commanders are concerned about the quality of their transient service. They will make every effort to resolve a problem if they have the necessary information. It is up to you, the aircrew, to give that information to the best of your ability. It's for your own benefit.

NOT RECOMMENDED

As long as there are tandem seats in aircraft, we apparently are doomed to repeat this old familiar scene:

Student returning to pattern in a T-38; stick travel to left restricted; aircraft controllable but only very slight roll could be made to left; straight-in landing made safely.

Postflight revealed rear seat survival kit/cushion had become dislodged and wedged between the seat, leg brace and stick. Sometimes this makes for a very interesting few moments. Not recommended.

ERRONEOUS ALTIMETER SETTING

A C-130 was making an approach to a base in Europe. RAPCON issued the weather observation and altimeter setting with initial radar contact. The aircrew questioned the altimeter setting of 30.31 and asked RAPCON for verification. The tower operator assumed that RAPCON had a garbled printing and read back the 30.31 teleautograph setting. Once again, the aircrew questioned the setting and RAPCON relayed the request through tower to the weather observer. However, it was not clear that it was the one inch difference from forecast being questioned. The reply once again came back 30.31. On the third query, the one inch change in the altimeter setting was caught and the weather observer corrected it on the teleautograph. What happened? The weather observer made the correct altimeter setting entry of 29.31 in all cases except the teleautographer, where he entered 30.31. This one inch change was not detected by personnel in the tower or at RAPCON. This incident highlights the obvious human error of controller misunderstanding, and incorrect recording by the weather observer. However, it specifically points out the necessity for an alert aircrew and good communications in a hazardous situation. IF IT DOESN'T SOUND CORRECT—QUESTION IT! ! !—Maj John D. Woodruff, Directorate of Aerospace Safety.

OPS TOPICS

CLEARED TO CROSS

After a C-141 landed at a civilian airport, the tower instructed "Taxi to end, cleared to cross Rwy 04L, contact ground." After taxiing off the active, the aircraft started across the other runway. The pilot of the C-141 saw a light aircraft (a Cherokee) on the runway but assumed that it was landing and would be well clear. After the C-141 was about halfway across the runway, the AC realized that the Cherokee was, in fact, on takeoff roll and stopped the C-141. The light plane barely cleared the cockpit of the C-141. The controller had expected that there would be sufficient clearance between the two aircraft but did not follow-up to assure separation.

CAP CADETS AT USAF ACADEMY

Two hundred sixty-eight former members of the Civil Air Patrol are now cadets in the four classes at the USAF Academy at Colorado Springs, Colorado.

The fourth class (Class of 1980) reported in June 1976 and was the first class admitting female students, six of which were former CAP members.

NEW NOTAM SYSTEM

Starting in August there will be a 90-day test of a new method of NOTAM transmission. Those bases participating in the test will no longer receive the present NOTAM summary or hourly updates. Instead, they will use the CONUS meteorological data system terminal (COMEDS) to request NOTAM information. (This is the same system used to request weather data for the 175-1.)

The system will provide current NOTAM information on request and provide the aircrew with a hand copy print-out of the NOTAMs they requested.

The system works like this: Airfields listed in the IFR Supplement will have an associated NOTAM automatic response to query (ARQ) code printed in parenthesis beside the ICAO identifier. When an aircrew wants NOTAMs for a base, they provide the COMEDS terminal operator with the ARS code for the base. The operator enters the code and within one to two minutes has a print-out for the aircrew.

IN A PICKLE

About 12 minutes after level off, an F-100 pilot accidentally hit the pickle button on the stick grip. At this point two drop tanks, a baggage pod and pylon all departed the aircraft. Then the pilot noticed that the master armament switch was in the "jettison all" position. It is not clear who left the switch in that position. The armament crew was sure they turned the switch to off. The pilot visually checked the switch but because the jettison position is 180 degrees opposite the OFF position the pilot didn't detect the error.

DON'T CAGE YOUR EYEBALLS

Even in this era of radar surveillance and mandatory IFR, the best protection is still visual separation when VMC. From a near miss report: "The sector controlling the Merlin did not advise the aircraft of the MOA activity prior to his entering the airspace, although the controller was aware the MOA was in use." The controller failed to provide the civilian aircraft with proper radar advisories. If the controller had done this the military aircraft would also have been advised of the existence of the VFR aircraft. This would have precluded the incident. (Controllers can make mistakes, too.) ★

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Accident Prevention

Program.



LIEUTENANT COLONEL

John T. Stadler*

113th Tactical Fighter Wing
Andrews Air Force Base, Washington, DC

On 17 January 1977 Colonel Stadler was number three in a flight of four F-105D's on a routine strike mission. The flight entered the range complex and split into two elements of two aircraft each. Colonel Stadler's element descended to 500' AGL and accelerated to 600 knots for a low level, high speed approach to the target area. Approximately 5 minutes into the low level portion of the mission, Colonel Stadler felt his aircraft suddenly decelerate and begin vibrating. He immediately zomed to a higher altitude and turned toward the base. During the zoom he discovered the EGT was slowly but steadily increasing. When he reached 10,000' MSL and leveled off, the aircraft continued to decelerate. He could not stabilize the altitude and airspeed even with the throttle set at full military. The engine EGT was increasing through 700° as the airspeed continued to decrease, and the vibrations became more severe. He began a gradual descent, jettisoned all external stores; however, these actions had little effect on the decreasing airspeed. At 250 knots the options to Colonel Stadler were extremely limited: immediate ejection, or the selection of afterburner on an already malfunctioning engine. He chose the latter. The afterburner lit normally, and the aircraft began accelerating. He set the throttle at 92 percent and the airspeed stabilized at 300 knots. Colonel Stadler declared an emergency and maneuvered the aircraft for a straight-in precautionary landing. Electing not to move the throttle until touchdown, he used pitch attitude, speed board, and S turns to lower his airpseed and drop the gear. After the aircraft made an uneventful landing, an investigation revealed that the engine had suffered extensive turbine damage. Colonel Stadler's rapid assessment and accurate diagnosis of a serious engine problem along with his superior airmanship resulted in the recovery of a valuable aircraft. WELL DONE! ★

*Colonel Stadler lost his life in an aircraft accident shortly after the incident related here.



The Stretched C-141

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30th Anniversary of the United States Air Force





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Our gratitude to Lt Col Russell B. Hodges, of this HQ, for the loan of the leather helmet and goggles featured on the cover, and to Mr. William Nord of San Bernardino, CA, for the wings and shoulder patches from his extensive collection.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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SEPTEMBER 1977 AFRP 127-2 VOLUME 33 NUMBER 8

NEWS FOR CREWS

Information and tips to help your career from the folks at Air Force Military Personnel Center, Randolph AFB, TX.

MAJOR VERN ELLIS and MAJOR BILLY TUDOR
Rated Career Management Branch
Air Force Military Personnel Center

A UPT/UNIT INSTRUCTOR TOUR

One of our earlier articles listed a number of rated "Special Duty Assignments (SDAs)" available for interested volunteers. One of those was the UPT/UNT Instructor tour with the Air Training Command. Most of us can recall with some clarity, our experiences in the undergraduate flying training program we attended—UPT, UNT, or perhaps both. Memories are great, but they seldom portray the "real world" in a constantly changing environment. In an effort to provide some up-to-date information for those interested in a new and challenging type of operational experience we would like to talk briefly about the ATC instructor tour for both pilots and navigators.

Our first step in examining the Undergraduate Pilot Training (UPT) program is to look at the IP force composition. The Air Force has established a goal of 40 percent first assignment instructor pilots (recent UPT graduates) and 60 percent pilots with other weapon system backgrounds as a manning objective for FY 1980. We are continuing toward that goal and now have IPs in ATC from all MAJCOMs and major weapon system areas.

The UPT environment itself has changed significantly in the past year. A command program, "Hasty Buck," has reduced restrictions and given the IP more latitude to use his judgment in developing the student's decision making process. This favorable trend combines with many other positive aspects of an ATC IP tour and provides added improvement to an already outstanding assignment. Flying time is still a big plus, averaging 30-35 hours a month. ATC IPs continue to compete very favorably for promotion, and the job offers a wide variety of additional responsibilities that should enhance personal qualities and expand an individual's operational background. For non-weapon system identified pilots, follow-on training opportunities are excellent. Follow-on training is normally available in every major weapon system category as well as mission support type aircraft. There are, for all IPs, many fine opportunities for headquarters jobs, either while in ATC or upon return to previous weapon systems.

Selection for ATC IP duty involves a screening process which includes Form 90 desires, flight records review, personal qualifications, local commander and MAJCOM recommendation, and finally, ATC acceptance for each IP. After arriving at your new base, approximately six weeks will be spent in aircraft qualification training. You then spend approximately 13 weeks TDY for Pilot Instructor Training (PIT) at Randolph AFB, Texas. The tour length for first-assignment IPs is three years, while the tour length for all others is normally four years. This three or four year tour is generally considered by most pilots to be a stable and enjoyable broadening experience.

Undergraduate Navigator Training (UNT) is located at Mather AFB, California, with highly qualified instructors representing every major weapon system in the Air Force. Navigator-Bombardiers and Electronic Warfare Officers are also included in the UNT instructor force to provide student exposure to the entire spectrum of aircraft and missions.

Assignments to UNT are stabilized 4-year controlled tours. To qualify, a navigator must have three years operational experience, instructor navigator experience (preferred), and a highly competitive record.

The Air Force recognizes the training benefits derived from an instructor force with varied operational experience. Inherent in such an arrangement is career broadening opportunity for each instructor through his association with officers from other operational backgrounds. Because of escalating training costs and other real world restraints, obtaining this broadening experience through weapon system cross-training is impractical. ATC, in seeking an instructor force with diverse backgrounds, provides officers this career cross-feed and simultaneously enhances the ATC training mission; and that's what it's all about. If you are interested, review AFM 50-5, update your Form 90, and check with your rated resource manager for further information. ★

A PILOT'S VIEW OF SPATIAL DISORIENTATION



Before we begin, a word about the title is in order. For far too long, most available information on spatial disorientation (sometimes called vertigo by the underinformed) has been oriented towards those with a degree in medicine or human physiology. We poor laymen have been swamped with *proprioceptive* sensors and *otolith* organs in the hopeful assumption that a thorough knowledge of the physiology of the human inner ear will enable us to master spatial disorientation. Unfortunately, it just isn't so.

What is needed, then, is *pilot* oriented information. Of course, there is still a valid question—will *pilot* oriented information help us to master spatial disorientation? I believe the answer is yes; provided the information is correct and presented in words and concepts that pilots can understand. That is what this article will attempt to do.

Let's begin by saying that the conscious mind continuously determines its orientation in space by sampling two sources of information —visual cues (which come through the eyes), and gravity/inertia cues (which come from muscle sensors and the balance organs in the ear). Admittedly this represents an oversimplification and physiologists will cringe—but it is a totally adequate description. Let us go on to say that the brain, when sampling gravity/inertial cues, has no adequate way of determining whether the cue results from gravity or inertia without the visual cue as a discriminating input. Further, if the brain is receiving only one cue, it will make its determination of the body's spatial orientation by considering only that cue; that is, although inputs from all cues are required to accurately indicate the body's orientation, not all cues are required by the brain to perform that function.

As long as a person walks on the surface of the earth, there is seldom a problem. The gravity/inertia cue results from gravity, the brain correctly perceives this, and down is down. No corroborating cue from the eyes is necessary. Place this person in the cockpit or cabin of

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MAJOR JIMMIE L. COOMBES
Commander, Det 2, 3636 CCTW
Nellis AFB, NV

an aircraft, however, and things change drastically.

Down is no longer down in the sense "towards the center of the earth." Instead "down," to the gravtiy/inertia sensors is in the direction of the resultant positive inertial vector (the G if you will.) This presents no difficulty as long as the aircraft is in straight-and-level, upright, unaccelerated flight, since "true down" and "perceived down" are in the same direction. Accelerate the aircraft in any dimension, however, and the potential for disorientation begins. Consider figures 1-5, which show depictions of "down" as perceived by the gravity/inertia sensors. All aircraft are experiencing one positive G.

It is easily seen in these simple cases that the brain is receiving an erroneous orientation cue from the gravity/inertial sensors in figures 2-5. If "spatial disorientation" is the inability of a pilot to correctly determine his positional orientation in three dimensional space, are the pilots in figures 2-5 spatially disoriented? The answer to that question depends on what these pilots' eyes are doing. If the weather is VFR, and the pilots are looking outside, and if they can see the natural horizon, then they will not be disoriented. Although the brain is receiving erroneous cues from the gravity/inertia sensors, it is receiving correct cues from the visual sensors (eyes). The brain has learned through long experience that the eyes are very reliable in their inputs, and the brain will resolve this conflict in favor of the visual cues.

The clever reader is now asking a pertinent question. If this conflict resolution in favor of the eyes occurs, and if the eyes are reliable in their input, then how can anyone who isn't blind be spatially disoriented?

Fortunately, the answer to this right and proper question is contained within the question itself, and the answer is in three parts:

1. The eyes are not necessarily reliable in their inputs.
2. A pilot in an IFR environment can become effectively, if not actually, blind.
3. The conflict may not always be resolved in favor of the eyes.

It is helpful to consider each of these points separately, and then to see how they can combine to disorient a pilot.

Anyone who has ever seen an optical illusion, or visited a so-called "anti-gravity" house, can testify that the eyes can be easily deceived. Since aircraft instrument panels are not designed with optical illusions built in, it is tempting to say "so what." The "what" is that the arena of flight is filled with optical illusions. Consider the pilot flying VFR above a sloping cloud bank (Figure 6). Or consider a pilot airborne on a dark night above sparsely populated terrain, when an indistinct horizon results in stars and ground lights blending together. Both of these pilots are flying along in the middle of vast optical illusions. The eyes can be fooled.

Fooled yes, but how can they be "effectively blinded?" This one is easy. Take our pilot, put a large volume of clouds or fog that he must penetrate in front of him, and he will be effectively blinded. Aha, you say! In that event, he will have reference to his flight instruments and will, therefore, *not* be effectively blinded. This is true in the ideal situation—indeed it is what the instrument "scan" or cross-check is all about. But if the pilot is required to shift his attention away from the scan for a few seconds—to refer to an enroute chart or approach plate, or to change the

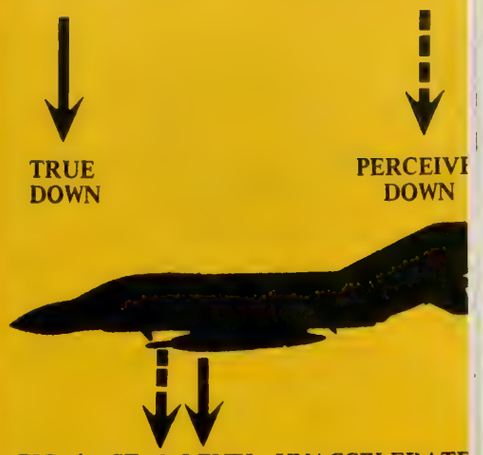


FIG. 1 - ST. & LEVEL, UNACCELERATE


FIG. 2 - ST. & LEVEL, ACCELERATING


FIG. 3 - ST. & DECELERATING


FIG. 4 - 45 BANK


FIG. 5 - 1"G" AILERON ROLL

A Pilot's View of SPATIAL DISORIENTATION

continued

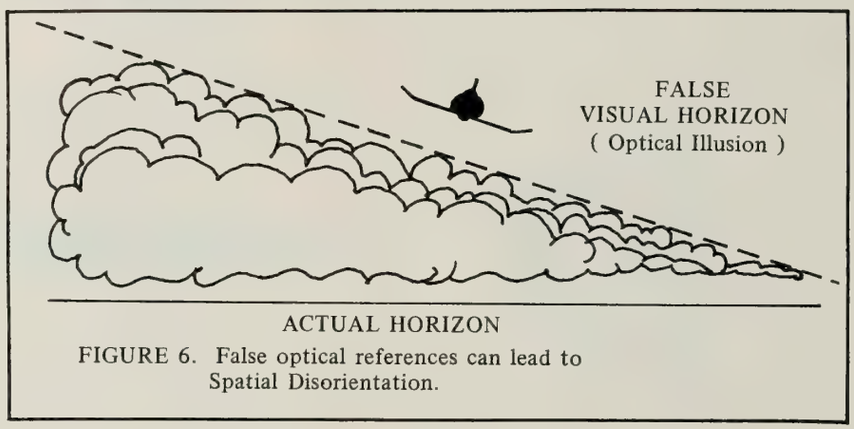


FIGURE 6. False optical references can lead to Spatial Disorientation.

frequency on a navigational radio —for the period of time that his attention is diverted, and as far as the visual orientation cue is concerned, *this pilot is effectively blind!* This leads to the third part of the answer to our original question.

Under what kinds of circumstances will the brain not believe the cue from the eyes? A simplified schematic of what happens to the mind of our pilot will be helpful in understanding this crucial point. Referring to Figure 7, we can see that orientation cues—visual and gravity/inertia—flow into the "decision center" of the brain. Under routine circumstances, such as walking down the street, the cues will agree with each other. The decision center then sends messages to the "control center" ordering muscle signals for whatever type of activity is being performed. In routine affairs, this entire activity is so automatic that it is performed practically subconsciously—like breathing, scratching, or any of hundreds of other movements we make without conscious awareness. (Note that the "decision center" in the schematic has been differentiated to depict the different levels of activity that occur there.)

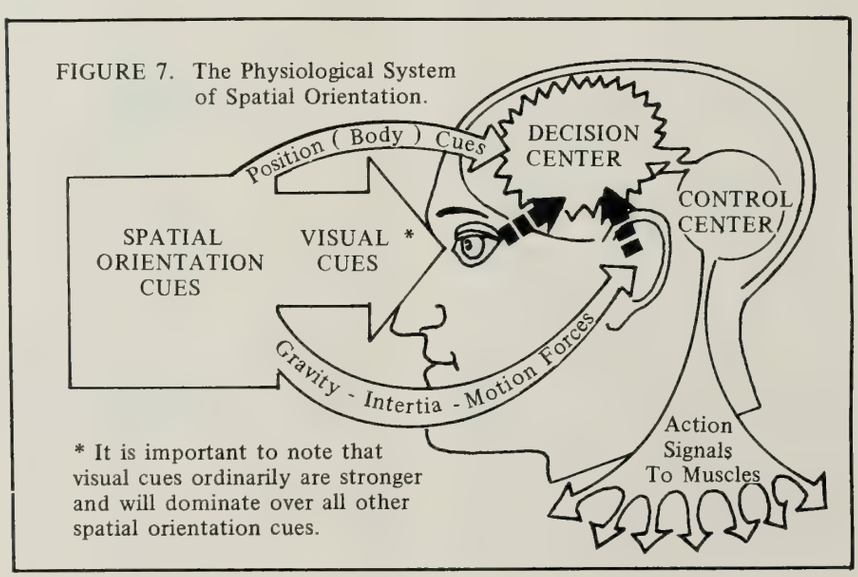


FIGURE 7. The Physiological System of Spatial Orientation.

* It is important to note that visual cues ordinarily are stronger and will dominate over all other spatial orientation cues.

In non-routine affairs, and learning to fly an airplane is certainly non-routine for normally earthbound homo sapiens, some of this activity must occur at a more conscious level. The more experienced a pilot becomes, the more automatic his responses to requirements for controlling the aircraft will become. In fact, many high-time pilots perform much of the routine of flying as automatically as walking. This is the simple result of vast experience.

Consider, however, a situation where very few pilots have the vast experience required to relegate the decision functions to the automatic mode—IFR flight. In this situation the pilot is performing an artificial, learned task (flying an aircraft) by reference to an artificial, learned, visual orientation reference (aircraft instruments) using artificial, learned rules (FARs, etc.). The second item here, the visual orientation reference, is the item that pilots never practice enough to make it automatic. True, the more it is practiced the more it tends to be automatic. But no one has, or is likely to have, enough actual IFR experience to make this automatic, even if the other two items do become practically second nature.

So here is our situation as we

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have it developed: Our pilot is flying along in IFR conditions making decisions about his three dimensional orientation in space based on inputs from his visual and his gravity/inertia sensors. Because dependence on the gravity/inertial cues has been a routine part of his life since he was born, he is more-or-less automatically sampling and interpreting these signals. His visual signals, however, are being considered more consciously. He has had to learn how to correlate inputs from an airspeed indicator, an altimeter, a vertical speed indicator, and an artificial horizon. Believing what these instruments tell his eyes about left and right, up and down requires a continuous, conscious effort as long as he can't see a natural horizon or horizon reference. However, other than a slight increase in respiration, heart rate, and adrenalin flow, nothing very significant has occurred . . . yet. Nothing is likely to happen, either, until a disagreement between the visual cues and the gravity/inertia cues occurs. But when such a disagreement happens, and if our pilot is in IFR conditions it *will eventually happen,* the stage is set for the onset of spatial disorientation.

A typical spatial disorientation encounter might go like this: Our pilot is flying along, straight and level unaccelerated with a normal instrument scan. Visual cues from the instrument panel consciously interpreted, and gravity/inertia cues, subconsciously interpreted, agree and everything is fine. Now let's introduce a false gravity/inertia cue. This can occur from aircraft maneuvering, accelerating, pilot head movement, etc. Remember from an earlier point that, without help, the brain cannot tell when the gravity/inertia cue is false. Whatever this signal may be telling the brain, it feels *right.* The perceived down feels like the real down. The visual cue from the instrument panel, however, is telling the pilot what is really happening to his aircraft. The conflict has begun.

The brain is receiving two types of orientation cues that do not agree, and the decision center must determine which cue to act upon. Under normal circumstances, there is still no problem. The decision center will opt in favor of the visual cue, and signals to the control center will be made accordingly. This pilot will, of course, have a nagging feeling of discomfort as long as the two sets of cues are in disagreement, but he will not have uncontrollable spatial disorientation. After the phenomenon that introduced the false gravity cue is "washed out" or terminated, the cues will again be in agreement and everything will be fine.

Suppose, however, that the pilot, in IFR conditions remember, is performing any of a series of maneuvers that are characteristic of an IFR flight plan (climbs, level-offs, descents, procedure turns, etc.), and which induce false gravity cues. While the pilot is trying to rationalize the discrepancy between his cues, his instrument scan is broken by a requirement to retune a navigational radio. *For the period of time that he is looking away from his instruments, his brain's only orientation cue is false.* He is flying an aircraft, however, and his control center requires continuous inputs. The brain, having no choice, begins to send signals from the decision center to the control center based on the erroneous cue. This pilot does not yet have spatial disorientation. His conscious mind is busy with a nav radio, and his subconscious mind is handling orientation matters (albeit incorrectly). There is no conflict between these purposes at this time, and hence no disorientation. The alarming aspect is, however, that the brain is satisfied about its three dimensional orientation based on incorrect information.

Now our pilot looks back at his instruments and attempts to reestablish his scan. At this instant, he will become disoriented. A true conflict within the decision center has begun, and the decision center will grow increasingly frustrated in trying to reestablish the dominance of the visual cue, which it *knows* is correct, over the gravity/inertia cue, which it *feels* is correct. The situation is critical, and, without the restablishment of visual cue dominance, it may prove to be fatal.

If this pilot is able to force his decision center to believe the visual cue again, he will move back to the previous stage of nagging discomfort until the disparate cues agree. If he is not, he will probably eventually impact the ground with his decision center still locked violently in the conflict struggle. One other possibility exists—he may eventually enter a trance-like state in which the subconscious forces the conscious to cease even considering the correct, but sensorily



unacceptable, visual cue. In this event, his mind will be at peace at impact.

This, then, has been an anatomy of a spatial disorientation incident. Granted, there are other types of spatial disorientation. There are situations, such as the rapid eye flicker encountered in nystagmus, where the eyes, though open, are no longer able to send meaningful information to the brain. There are the so-called flicker vertigo incidents encountered by helicopter pilots. There may even be cases of true vertigo, where the gravity/inertia cues from different sensors are in disagreement and, therefore, these no longer "feel" right in the decision center.

But it doesn't matter, really, because spatial disorientation is spatial disorientation. The key to beating it is threefold: *(1) Avoid it, (2) If you can't avoid it, do not lose visual dominance, (3) If you lose visual dominance, get it reestablished as soon as possible.* With these points in mind, the following recommendations will help you to survive the inevitable encounter with spatial disorientation:

1. Be aware of situations that are likely to lead to spatial disorientation encounters.

- Flying in IFR conditions.
- Flying on dark nights above sparsely populated terrain.
- Flying formation under either of the above conditions.
- Flying in marginal conditions, especially in and out of cumulus cloud formations.

2. If you encounter the nagging discomfort that indicates the onset of conflict, do not lose visual dominance. Force the conflict to disappear.

- Practice IFR flight, and your instrument scan, as much as possible. The more experience you have in visually interpreting your instruments, the stronger the links in the decision center relative to this cue will be.
- Try not to allow the instrument scan to be broken unless the aircraft is in an unaccelerated mode of flight.
- Keep aircraft maneuvering to a minimum, and make all control inputs smoothly, positively, and at controlled rates.
- Keep your head movements slow, and as smooth as possible.

3. If you have lost visual dominance (the nagging discomfort is getting worse), get it reestablished as soon as possible.

- Cease maneuvering. Return the aircraft to straight-and-level, unaccelerated flight while you reestablish a firm instrument scan centered on the artificial horizon.
- If possible, transfer control of the aircraft to another pilot, or an auto-pilot, if one is aboard the aircraft.
- Talk aloud to yourself, describing the attitude of the aircraft as indicated by the flight instruments. This will provide an additional correct input to the conscious mind via another route (the auditory nerve.)
- One technique that some pilots find useful is to fly using the cross-cockpit instruments (or standby instruments) for their scan. Increased concentration is required to do this, and is apparently the reason it works for some pilots. One point—try this in practice before trying it in a real situation. The technique may not work for you . . . in fact, it may be counterproductive. If so, scratch it from your repertoire.

Do not fear spatial disorientation—but do not underestimate it either. You *will* have a spatial disorientation incident if you fly in IFR conditions. You can, however, meet it and beat it.

Major Coombes developed the material for this article while serving as the Chief of Academic Training for the USAF Instrument Pilot Instructor School. Much of the background information for this article is adapted from a study released by the School of Aerospace Medicine, Brooks, AFB, TX, entitled "Spatial Orientation Training, A Staff Study," January 1975. ★

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THERE IS A WAY

Annually the Air Force recognizes a given number of individuals, units and commands for outstanding performance. However, competition is keen and not all win major awards. To recognize all of those, AEROSPACE SAFETY is featuring one or more in each edition. In this way we can all share in recognizing their fine performance and, perhaps, learn some valuable lessons.

Nominated for the Chief of Staff Individual Safety Award

Colonel James S. Meador

As Director of Maintenance Engineering, Aerospace Defense Command, Colonel Meador directed aircraft and munitions maintenance programs that resulted in the command completing flying operations in 1976 without a single major accident attributed to maintenance. Simultaneously, the command had the best explosives safety record in its history.

Under Colonel Meador's management, trim problems and defective oil coolers on the J75 engine in the F-106 were analyzed and solved, thereby increasing the safety of the engine.

In explosives safety an average of 23-24 mishaps per year was reduced to six by a new approach and complete revision of the command explosive safety plan.

Master Sergeant Glendon R. Fletcher

Master Sergeant Fletcher was directly responsible for updating, revising and broadening the Nuclear Safety program for Det 3, 425th Munitions Support Squadron, CFB Baggotville, Canada.

Seeing the Nuclear Safety NCO as the key factor in the program, he devised a training plan designed to inform personnel at all levels on the basic principles of Nuclear Safety. The overall test average was increased significantly. The success of the program was directly attributable to Sergeant Fletcher's ability to set clear, concise objectives and present them in understandable writing. Through his efforts the detachment received an "Outstanding" rating on the two capability/management effectiveness inspections during Sergeant Fletcher's tour as Nuclear Safety NCO.

Nominated For The Colombian Trophy

The 20th Tactical Fighter Wing

The 20th TFW, during the period 1 January to 31 December 1976, flew a total of 6,533 sorties and over 17,000 hours completely accident-free. This included setting an F-111 record of 91 sorties flown in one day during a NATO Tactical Evaluation.

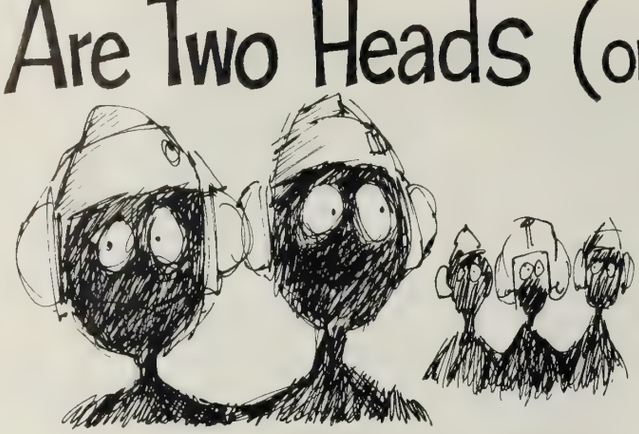
What makes the Upper Heyford, England, based unit's record even more remarkable is the fact that during this period F-111 units were experiencing serious engine problems. A number of major and minor incidents was experienced by other F-111 units and numerous mandatory TCTO's and inspections were required prior to flight.

Due largely to maintenance and safety emphasis on reporting of engine problems, the 20th TFW was able to anticipate these engine difficulties. Through strict adherence to engine maintenance standards and early safety emphasis to aircrews on new engine problems, the 20th TFW was able to limit all engine mishaps to an incident category. Although sorties had to be cut back, the wing was still able to safely meet all of its NATO commitments.

Also during the summer of 1976, the wing deployed to RAF Greenham Common while their own runways were being repaired. This deployment caused numerous problems for the Flying Safety Office, but the most significant was a flying operation set in the midst of the most concentrated cross-country glider area in the United Kingdom. Through a tremendous educational program, including wing prepared handouts for local glider pilots, only one airmiss between a glider and an F-111 occurred during the entire deployment.

These accomplishments, and others, under the prevailing conditions testify to the professional stature of the 20th TFW. ★

Are Two Heads (or three heads, or four heads



MAJOR THOMAS R. ALLOCCA
Directorate of Aerospace Safety

"A camel is a horse designed by a committee." There are those in the Air Force who seize upon the sentiment expressed in this phrase, to shy away from any and all organizational attempts to introduce an element of corporate decision-making into their daily lives. And, for some at least, this distaste for collective judgments carries over into the subject of "committee" effectiveness in Air Force cockpits.

At the top it will be emphasized that this article has *not* been prepared to provide comparisons—and fuel the ensuing arguments—between mishap rates among different aircraft. There is scarcely a subject in Air Force flying safety circles that has given rise to more debate than the subject of comparing rates among different categories of aircraft.

Since most would agree that the fighter mission is "inherently" more hazardous than the cargo mission, it logically follows that fighter mishap rates should be higher than cargo rates. But, how much higher? Twice as high? Four times?? Ten times??? That question is infinitely complex, laden as it is with imponderables and beset with "apple-orange" complexities such as differing mission requirements, philosophies and constraints. And it will not be answered here.

This article has also *not* been prepared as an advocacy-briefing for a second pilot, or navigator, or systems operator, or The "lone eagle" sentiments of the single-seaters are legend, matched only by those who believe the multi-crewed aircraft is the only way to fly.

This article has been prepared to provide a limited review of USAF mishap experience for the 1972 to 1976 time frame. Perhaps it will answer some questions; perhaps it will reinforce some strongly-held views; hopefully it will inject a bit of objectivity into a subject area whose true dimensions have long been obscured by partisan rhetoric. The numbers—to corroborate this objectivity—follow:

THE BIG AIRPLANES AND THE LITTLE AIRPLANES

The type of mishaps considered in this comparison are "collision-with-ground, off range" and "pilot-induced landing" mishaps. (NOTE: Collision-with-ground, off range, (CWG/OR) and pilot-induced landing (PIL) mishaps are categories developed by the Safety Analysis Branch in the Directorate of Aerospace Safety. These mishap types are, for the most part, aircrew-caused.) The aircraft categories include all bomber transport types (including the T-43, T-29 and T-39) and the fighter trainers. The mishap statistics are:

TYPE AIRCRAFT	FLYING TIME '72-'76	ACCIDENT RATE* (CWG/OR)	ACCIDENT RATE* (PIL)
Bomber/Transport	9.8 million hours	0.13	0.25
Fighter/Trainer	9.4 million hours	0.27	0.56

*Per 100,000 hrs

The numbers reveal that the rates are roughly inversely proportional to the number of people "watching the store." One must use caution in drawing any sweeping conclusions from the PIL rate for several reasons, such as: The fighter trainer fleet makes many more landings per flight hour; fighter/trainer landing speeds differ somewhat from those of the bomber/cargo fleet; and fighter/trainer landing requirements impose a greater aircrew workload than that incurred by the bomber/cargo aircrews.

BIG AIRPLANE AND BIG AIRPLANE (KC-135 AND C-141)

This is an interesting comparison, contrasting as it does two multi-crewed, four-engine aircraft which accumulate large yearly flying hour totals. Among a series of small differences, however, one could include crew size: The C-141 uses a five-man crew; the KC-135 has a crew of four.

The mishaps reviewed include all KC-135/C-141 major accidents in which "Operations Factor/Operator" (a mishap descriptor used to denote an aircrew-caused mishap) was cited as a cause.

TYPE AIRCRAFT	FLYING TIME '72-'76	MISHAP RATE* (MAJOR ACCIDENTS IN WHICH OPS FACTOR/OPERATOR WAS CASUAL
KC-135	1,431,059	.35
C-141	1,716,742	.17

*Per 100,000 hrs

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...) Better Than One?



LITTLE AIRPLANE AND LITTLE AIRPLANE (A-7 AND A-37)

The mishaps selected for this comparison include those A-7 and A-37 "collision-with-ground, on-range" accidents in which the aircraft was destroyed.

TYPE AIRCRAFT	FLYING TIME '72-'76	DESTROYED RATE* (RNG/CWG MISHAPS)
A-7	429,433	1.64
A-37	186,334	1.06

*Per 100,000 hrs

It seems that the two-seat A-37 has fared somewhat better (at least from this limited perspective) than the single-seat A-7.

SINGLE-SEAT ATTACK AND TWO-SEAT FIGHTER-BOMBER (A-7 AND F-4)

Any conclusions drawn from this comparison must be tempered with the knowledge that the two aircraft fly different mission profiles with significantly different mission taskings.

The mishaps considered include only those A-7 and F-4 "pilot-induced control loss" accidents in which the aircraft was destroyed.

TYPE AIRCRAFT	FLYING TIME '72-'76	DESTROYED RATE* (PILOT-INDUCED CONTROL LOSS MISHAPS)
A-7	429,433	1.40
F-4	2,312,455	.65

*Per 100,000 hrs

STRATEGIC BOMBER AND STRATEGIC BOMBER (B-52 AND FB-111)

The B-52 flew approximately ten times as much as the FB-111 in the 1972 to 1976 time frame. The mishaps reviewed are those in which the aircraft was destroyed and the "operations factor operator" cause was cited.

TYPE AIRCRAFT	FLYING TIME '72-'76	DESTROYED RATE* (MISHAPS IN WHICH OPS FACTOR/OPERATOR WAS CASUAL)
B-52	1,000,422	.40
FB-111	94,145	1.05

*Per 100,000 hrs

The multi-crew B-52 has experienced a lower rate than the FB-111. The mission profile of the two bombers—while similar in many respects—differs in this regard: The FB-111 low level airspeed profile is considerably higher than that of the B-52.

I began this article by paraphrasing the "lone eagle" sentiments of the single-seaters. For these hardy souls, the airmanship task is formidable—technology and engineering have produced aircraft of mind-boggling complexity and sophistication. You fellows who fly without the benefit of others' judgments . . . well, you've a professional challenge of the first order.

The statistics cited in this limited review suggest that crew composition may influence selected mishap experience—at least for the aircraft types and accident categories reviewed herein. And I suppose USAF's senior planners had such things in mind when contemplating the appropriate crew complement for an F-4, C-141 or B-52. The "accident-types" chosen for inclusion in this article were selected with design: They are the kinds of mishaps which crew composition should influence. These mishaps—be they "collision-with-ground" or "pilot-induced landing"—have this in common: They can be prevented by an increase in awareness, discipline and coordination among Air Force aircrews.

The crew coordination demands on a copilot, or navigator, or systems operator, or flight engineer should be many. Knowledge of correct individual aircrew duties is not enough; a good crew coordinator cannot be content to operate merely as a checklist-follower, smug in the knowledge that his job has been correctly performed. He must have knowledge of all unsafe aircrew practices and be bold and aggressive in questioning the judgment of the aircraft commander when circumstances dictate he do so. He must be able to readily detect unsafe situations and influence the progress of the flight when he is in doubt as to its successful completion. To the extent that he does these kinds of things —be he copilot or navigator or systems operator—he will be an effective "crew coordinator" and, in his case at least, two heads will be better than one. ★

BIRDS ORGANIZE

LTJC D. C. BLANTON
Naval Safety Center



TODAY, a high official for COMFUNDGAC (Commander, Feathered Union of Ducks, Gulls, and Chickens) and COMFAAC (Commander, Federation of All Airborne Critters) reported that due to prolonged grievances, the two organizations would join together in a strike against all man-made flying machines. The official stated that he believed the strike would be "quite lengthy in duration."

In the past, splinter factions from the two groups had engaged in strikes on their own. Now, it appears that a concerted effort will be made to instruct all members in proven methods of effective bird strikes. Extensive class work already has been completed by many of the members. An inside source (identified only as "Deep Beak") informed this reporter that final training included an inflight demonstration by veteran migrators.

As proof of the groups' seriousness, he included a picture of one of their recent strikes. He noted that the difficulty of this particular strike was increased because the pilot of the A-4 had his visor down. Degree of difficulty is determined by the skill required to injure the pilot or cause Alpha damage to the aircraft.

"Deep Beak" volunteered that the timing of this strike would provide the group the greatest element of surprise. He said that many people mistakingly believe that bird strikes occur most often during the migratory season. "Deep Beak" explained that statistics show there is no correlation between time of year and frequency of bird strikes. Apparently, an undetermined but substantial number of bird strikes involve nonmigratory birds.

When questioned about what could be done to avoid this immi-

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IN STRIKE

nent bird strike, "Deep Beak" produced a programmed text entitled "Effective Measures Taken by Intelligent Aviators (Human) to Prevent Bird Strikes." The text apparently had been used by FUDGAC and FAAC in ground school to inform the birds of measures taken by humans to avoid bird strikes. The birds' plan was to counter these measures by changing their own behavior patterns. However, "Deep Beak" stated that this approach had been unsuccessful. Important steps listed in the text and used by humans to avoid bird strikes are:

1. Learn about the bird life in the area where you operate. Then avoid areas and altitudes where birds are known to congregate.

2. When birds are encountered in flight, remember that they will try to avoid aircraft. Many migratory birds will do this by diving. Therefore, avoid flying directly under birds if there is a reasonable alternative. Help birds avoid aircraft by reducing airspeed at low altitude, if practicable. Showing landing lights at night will help also.

3. Some birds have learned to avoid aircraft by predicting the aircraft's flightpath. What's the old fighter pilot saying about "a predictable flightpath being for the birds?" Maybe there's new meaning to that.

4. If you collide with a bird(s) and there is any probability that a bird has been ingested by an engine, consideration should be given to landing at the nearest suitable airport. Statistics show that there is a good chance of foreign object damage when birds are hit.

5. Operate with your helmet visor down at all times (use clear visor at night). If you have a dual visor helmet, put both visors down. This can be an important factor in preventing serious injury in case of a midair with a bird.

6. Recognize that bird strikes occur most often during takeoff and landing. Keep a good lookout and be certain to report birds—on and about the airport—to the tower. Also. when applicable, report flocks of birds to the controlling FAA agency so that others may be warned.

This first meeting with "Deep Beak" then abruptly ended. He stated that he already had said too much. I did get him to agree to another meeting if conditions permitted. I honestly don't know who "Deep Beak" was. The only clue I have to his identity was the monogram on his shirt—J.L.S.—Courtesy *Approach,* August 1977. ★



ON CHECKLISTS

SQN LDR PETER WHITE, RAAF
Directorate of Aerospace Safety

The importance of conscientiously accomplishing aircraft checklists is drummed into us virtually from Day 1 of our flying career. Just what **not** completing them properly will do to you is graphically illustrated in the following examples:

The crew had completed one trip in the aircraft and on return a minor hydraulic leak was discovered in a gear well. The crew left the area to refile, while maintenance, including gear retraction tests, was performed on the aircraft. When the crew returned, one of the members commenced the thru-flight checklist (OK in this case, but check Section II of your Dash 1 and see what it says about thru-flight checklists and maintenance).

He was interrupted during the checks and left the cockpit to deal with some paperwork. When he returned, the rest of the crew had taken their places and they "completed" (but didn't restart) the checklist. After engines were started and hydraulic power applied, the aircrew experienced a lifting motion within the airplane. It then settled to the ground on the landing gear, which was retracting! As the propellers contacted the ground, one separated and tore through the fuselage, causing major structural damage.

The gear handle was then observed to be in the UP position.

The crew were set up for this mishap by maintenance procedures which created a situation in which the gear handle could be left in the UP position. In addition, neither maintenance supervisory nor quality assurance people inspected the cockpit after maintenance completion. But what caused an experienced crew to overlook such an obvious error? The accident board found deficiencies in their approach to the checklist:

- Individual attitudes tended toward "personal technique" in completing the checklist. Both the pilot and copilot were performing other tasks when the associated action which led to the gear retraction was made:
- Crew coordination and discipline were poor.
- The sequence of events prior to the mishap suggested a "business as usual" approach to the mission, i.e., the old enemy, complacency.

Let's look at another case: the aircraft was being flown back to home base with the landing gear down lock pins in place because of a system malfunction. Prior to the aircrew's arrival, the aircraft was moved, which required part of the nose gear assembly to be disconnected. It wasn't reconnected. This wasn't picked up until, on the takeoff run, a severe vibration heralded the collapse of the nose gear, and the nose dropped to the runway. Factors in this "oversight": a rushed pre-flight, fatigued crew member, and another old adversary, "get-home-itis!"

An incident which could have had more tragic results occurred when a ground crewman, thinking that the aircraft was finished for the day, shut off the oxygen supply at the bottles. In flight, the pilot suffered hypoxia. He had made an "abbreviated" preflight inspection.

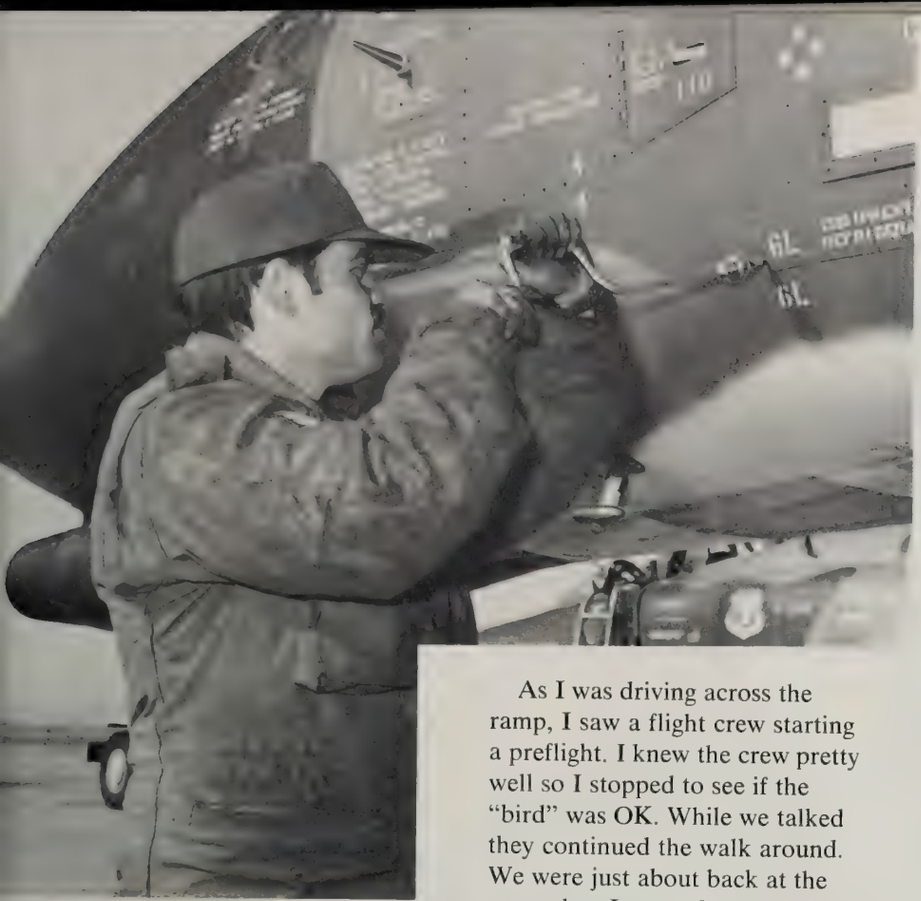
In all these, as in many other, cases the mishap would have been averted if the aircrew had performed their pre-flight checklists conscientiously. Sure, other people failed to do their job, too, but the aircrew are generally the last link in the accident chain, and physically and otherwise, suffer most from the mishap.

We all know of airborne situations as well, where fatigue, preoccupation with a problem, a "just another milk run" attitude. or any of the many other distractions produced a situation where the checklist just wasn't done correctly and an item was missed or wrongly carried out. Sometimes a quiet reminder from another crewmember picked it up, sometimes it revealed itself after the "white-knuckles-body-tensed-up-to-die" stage had come and gone.

In all cases, the result hopefully, was a wiser aviator.

Checklists probably won't get you out of every tight spot you're likely to encounter, but, properly employed, they sure will keep you from getting into a lot of those spots in the first place! Much care, thought and conscientious effort went into compiling yours. Use it in the same spirit. ★

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LET'S KEEP THE RAIN—WET

SMSGT HAROLD O. EASDALE
Directorate of Aerospace Safety

My job as OMS line chief has its ups and downs. At least it's never dull—always in the action or maybe I should say, in the hot seat.

The recent increase in dropped objects has caused a lot of attention in the squadron lately. I knew that improper maintenance actions were a cause for a good percentage of panels coming off in flight, but after all, we are the only ones pulling them off every day. After going over every idea we maintenance guys could think of, I started to feel that, if we were ever going to get a handle on preventing dropped objects, we were going to need all the help we could get.

I decided to go have a talk with our QC officer, who acted as our unofficial representative with the flight crews.

As I was driving across the ramp, I saw a flight crew starting a preflight. I knew the crew pretty well so I stopped to see if the "bird" was OK. While we talked they continued the walk around. We were just about back at the nose when I spotted a panel that didn't look right. It was in position and all the fasteners were flush, but something just struck me as wrong. After tapping on the panel I found out what it was. Only *two* of the 16 fasteners were secure. The rest were just *pushed in.*

Well, we were lucky. If that panel had come off there was a good chance it would have gone right in the intake. Of course, I scheduled a little talk with the crew chief to get to the bottom of why the panel was only tacked on.

But what really bothered me was why I caught the panel not being secured, and the flight crew didn't.

I thought a long time about that. I couldn't fault the crew because the panel *looked* fine. Then it hit me! Awareness! I realized that I always look closely at that particular panel because I know it comes off so often it ought to have a zipper. Because I was aware of that, I subconsciously expected something to be wrong with it.

Now I knew who we needed help from—all the flight crews. They could back up our efforts. Provide the second chance. But first we would have to help them—to make them more aware.

Well, I finally made it to QC. With their help and experience we made up a little course for all the crew members. It only took a few minutes, but showed which panels are commonly removed, which panels most commonly become dropped objects (Hmmmm! Just about the same list), which panels are often just tacked on for towing (how about that—same list again). We also covered the different types of fasteners and common problems, i.e., worn nutplates, fastener too long, too short, bad design, etc.

When we finished our little pitch, it was pretty obvious that certain panels were far more likely to become an incident than others. Of course, any panel might not be properly secured, but our problem list had a much better chance. All our crews were told to *expect* that these panels would not be right.

Remember, due to frequency of removal, poor design, practice of "tacking" them on, etc., there are a few panels that come off more than others.

Learn these panels on your aircraft (QC can help), take a good look at them on walk around and remember—dropped objects are all our problem. ★

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How Low

MAJOR MIKE REAVEY
Directorate of Aerospace Safety



A relatively common gripe we hear from pilots refers to the restrictions placed on training. The complaint usually goes something like this: "Safety runs the operation, training is watered down, our accident record looks great, but what happens when the war starts?" The problem, obviously, is balancing the realism of our training with the constant pressure to conserve our resources for the day the balloon goes up.

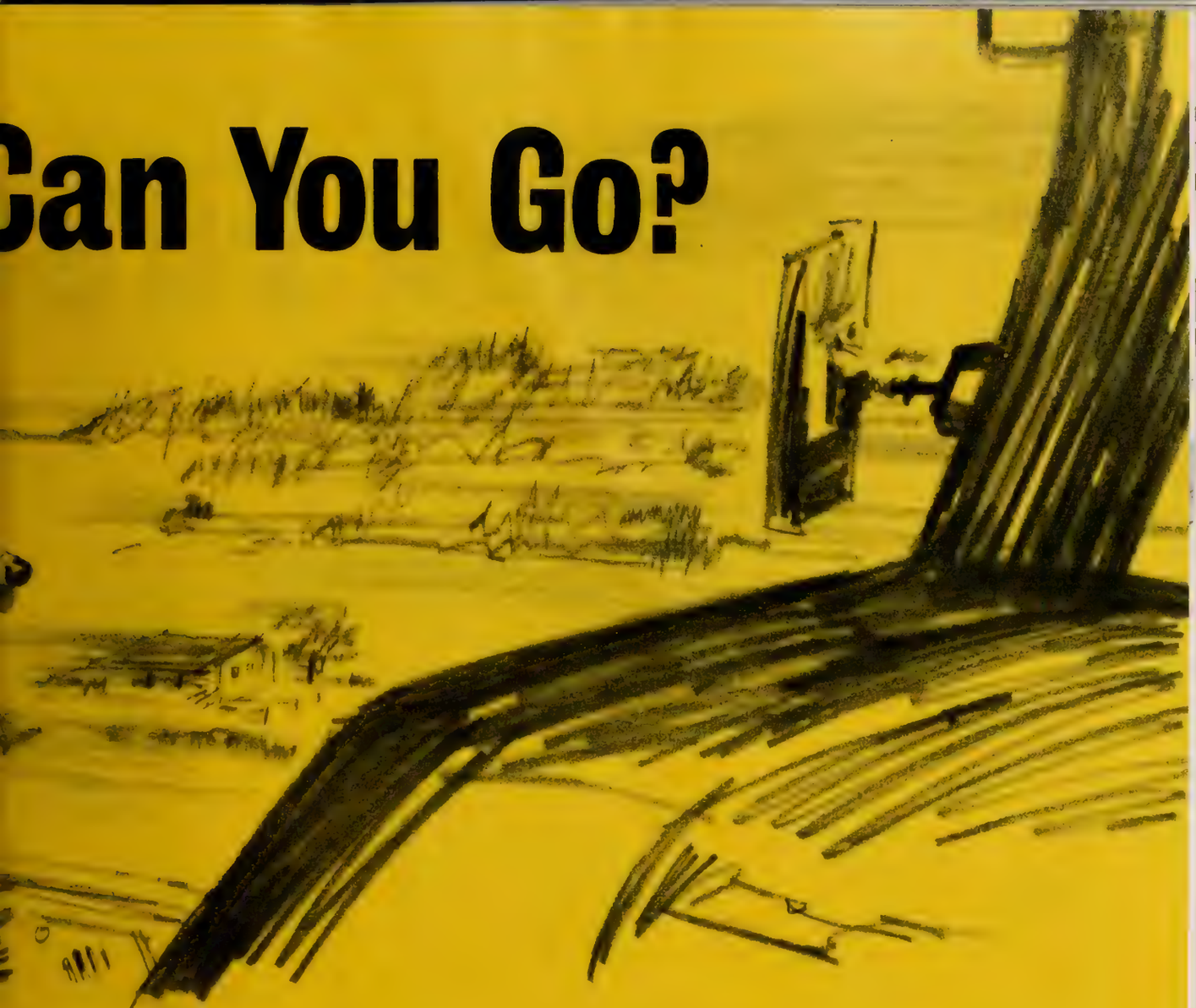
The rapid proliferation/increased capabilities of SAMs and lessons learned in SEA dictated a change in our tactics. Typical training scenarios encompass low-level navigation and ingress to a target area, pop-up or level delivery and low-level egress out of the area. Until recently, altitudes for this type scenario were restricted to 500 feet to 1,000 feet AGL enroute and 200 to 300 feet AGL for range operations.

Most jocks will agree a 500-foot low level is neither terribly challenging nor tactically feasible. We are now working our way down to 100 feet AGL low levels and conceivably could go lower. From the standpoint of realistic training, this is a quantum step forward. From a safety standpoint, it could be a quantum step backward unless we recognize and effectively cope with the inherent hazards involved.

The tasks do not change significantly. We will continue to read a map, maintain formation position, provide some degree of mutual support, update avionics, monitor aircraft performance, etc., etc.

The difference, of course, involves how we accomplish the tasks: At 500 feet AGL you couldn't "fall asleep at the stick," but these tasks could be accomplished with no major problems. At 100 feet AGL, the time element is significantly more critical, i.e., a 2-3 second span of inattention could be disastrous. Aircraft control will become more critical and tasks which detract or degrade it may need modification. Let's look

Can You Go?



at some of these tasks and how they may be modified.

NAVIGATION At 500 feet AGL, you can afford time for relatively long peeks at the low level chart. At 100 feet AGL, a quick glance is all you can afford. It appears even more thorough route study will be required almost to the point of memorizing the route.

FORMATION FLYING Tactical formations vary considerably but all have one thing in common, i.e., maintaining good position. This requires diverting attention from the area directly at 12 o'clock and at 100 feet AGL, the time you have to check position is compressed. A smooth lead will be a big help.

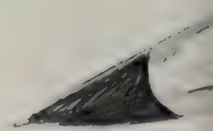
MUTUAL SUPPORT Once again you are tasked to divert your attention from 12 o'clock to 3 or 9 and possibly 4-8 o'clock areas. Flying at 100 feet and looking over your shoulder is a disconcerting thought. Learning how to scan/clear more effectively could reduce the time required to do the job.

AVIONICS UPDATES For those aircraft with navigation/weapons computer capabilities, data entries may be required en route. Typing at Lat/Long, Tgt Info, etc., must be done with minimum "head in cockpit." The smart money says do it on the ground whenever possible and learn to do it by "feel." In other words, minimize the requirement to look at the panel. Who knows, the old "blindfold cockpit check" may take on an entirely new meaning.

There are other areas which may present problems, e.g., maneuvering, birdstrike potential, depth perception, terrain recognition. We must identify these problem areas and develop the techniques/procedures necessary to eliminate or at least minimize them. As always, the best source of information will come from the guys who do it. The operators will decide if aggressive, invaluable, *realistic* training is here to stay. An adverse trend in low altitude training mishaps will almost certainly jeopardize this type training. The challenge is there and the door is open. Let's keep it open. P.S. Trim nose up. ★

Fire

CAPTAIN VICTOR G. GRAHN
27th Tactical Fighter Wing
Cannon AFB, NM



Our call sign that day was DRYLY 62. The mission was scheduled as an instructor weapons system officer (WSO) upgrade sortie. Takeoff, climb out, and cruise to the entry point of low level Training Route (TR) 288 were normal. Auto terrain following navigation to Green River RBS site and five "large charge" attacks were successfully accomplished. High altitude cruise to Cannon AFB transition areas 6 and 7 was accomplished where the syllabus required aerobatic maneuvers, and F-111 flight characteristics were to be demonstrated.

IFR was cancelled with ABQ Center and we entered the areas with a barrel roll, followed by a lazy eight and entry to a chandelle to the left. At the top of this maneuver, in a nose high-low airspeed condition, the wheel well hot caution lamp illuminated. Immediately, I turned the air source selector knob to off, rolled the aircraft to ninety degrees of bank, allowing the nose to fall, and opened the speed brake. (The Bold Face procedures for "Wheel Well Hot" have changed since this incident.) The WSO rapidly referred to the checklist for wheel well hot procedures.

Approximately 15-20 seconds later, as the aircraft was slowed to gear lowering airspeeds, in accordance with the checklist. the left engine overspeed caution lamp illuminated. As I checked the left engine instruments, the left engine fire warning light came on. I rapidly retarded the left throttle to off, depressed the fire push button and actuated the fire extinguishing agent. Confirming all Bold Face procedures were accomplished and the left engine was shut down, the WSO provided steering to Cannon AFB, the nearest recovery base, approximately 135 NM away.

Due to the distance from Cannon, the continuing fire light (which remained on for the duration of the flight), fuel considerations, and marginal single engine flight performance, I elected to leave the landing gear retracted and cycle the speed brake to vent the wheel well area during the return flight.

After two unsuccessful attempts to contact ARTC Center on UHF, I directed the WSO to select guard on the UHF and squawk emergency on the IFF/SIF. A UHF guard transmission was made and communications were established with several agencies and aircraft. Both the range officer at Melrose Bombing Range and AGE 32, an F-111D in the bombing pattern at the range, responded to the call. The range officer alerted the Supervisor of Flying and AGE 32 maintained an airborne communications link.

DRYLY 62 continued toward Cannon AFB, cycling the speed brake to vent the wheel well area and using power as required to maintain airspeed and altitude. Radio contact was established with the Supervisor of Flying approximately 65 NM north of Cannon. At this time, we felt we would have sufficient fuel for the recovery with the gear extended and attempted to extend the speed brake in order to slow to gear extension speeds.

As I actuated the speed brake switch, nothing happened, we noted the utility hydraulic system pressure was zero. With the loss of the utility hydraulic system and the left engine primary hydraulic pump inoperative, the aircraft was forced to fly with only one of the aircraft's four hydraulic pumps operating.

The WSO had been reviewing the procedures with me for a single engine landing, but now with the utility hydraulic system failure, he immediately referred to the hydraulic system failure landing procedure. As the aircraft was slowed to required airspeeds for slat and flap extension, fumes were noticed in the cockpit and we selected 100 percent oxygen. Emergency extension of the slats and flaps were accomplished without incident. As we slowed to gear extension speed, I had the WSO pull the emergency gear extension handle. The emergency gear handle pulled normally; however, there was no indication of gear extension. At this time, a chase aircraft (AGE 32) joined DRYLY 62 and confirmed the gear was not down, but also stated there were no indications of fire.

DRYLY 62 was on an extended final and we elected to proceed straight through initial to a visual downwind, in order to make further attempts at gear extension. With AGE 32 on the left wing, the aircraft was porpoised in order to apply "Gs" to aid gear extension, but with no effect. At this time, it became apparent the gear was not going to come down.

With the aircraft rapidly approaching emergency fuel condition, the Supervisor of Flying ordered the runway foamed for a

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the well



gear up approach and barrier engagement. I pulled the hook release handle and AGE 32 confirmed the hook was down but stated that the aircraft was trailing a slight amount of smoke from the left engine area. At this time, DRYLY 62 was turning to an extended final and the on-scene commander asked for a few more minutes to complete the runway foaming. As there had been no new indications of fire, other than the slight smoke trail from the left engine area, I elected to execute a 360 degree turn to give more time for completing the runway foaming. As the aircraft turned from the runway, AGE 32 indicated the smoke was increasing and he could see fire in the wheel well area. Immediately, I requested the Supervisor of Flying to clear the runway for an immediate landing.

As the aircraft was turned toward the runway, rudder pedal kick-back was experienced and and AGE 32 stated the fire was getting worse and objects were falling from the underside of the aircraft.

During this time, the WSO reviewed ejection procedures over the interphone in case ejection was required; however, I felt I had control of the aircraft and we elected to continue. As I flew the aircraft, the WSO cleared the cockpit of loose articles and monitored engine instruments for additional malfunctions. As we approached touchdown, the aircraft suddenly pitched up. I pushed forward on the stick and advanced power to afterburner on the right engine to gain airspeed, in case ejection was necessary. As thrust started to increase, the aircraft responded to control stick inputs and the nose came back down. Realizing a successful barrier engagement was assured, I reduced power.

Approximately 20 minutes after the first indications of a fire, DRYLY 62 successfully made an approach end barrier engagement, on a foamed runway. The foam extinguished the fire as the aircraft slid to a stop. I shut down the right engine and the WSO and I safely evacuated the area.

As a result of this experience, the author has provided the following analysis of the handling of this emergency and a number of recommendations.

The first decision was not to lower the landing gear for the wheel well hot indication. With the indication of a left engine fire, the distance from Cannon AFB, our fuel state, and the single engine performance of the F-111D with the gear extended, I felt that it would be wiser to return to the field faster at altitude and with a fuel reserve, than low and slow with a high fuel flow. Another factor that

FIRE IN THE WELL continued

influenced my decision to leave the gear retracted was the loss of throttle boost after I turned the air-source selector knob off. This would indicate that the bleed air shut off valve had closed and any hot air leaks in the wheel well had been stopped. Prior to this occurrence all wheel well hot caution lamps had been caused by a hot air leak or faulty sensing system. I feel this was a sound decision given the conditions at the time.

The decision to use guard to establish communications was made a little hastily. I now feel that I should have tried another frequency first or used UHF 255.4 to contact a flight service for relay to Cannon AFB Command Post. By using guard, several agencies and aircraft answered our call which made communications a little confusing at first. At the time, however, we felt that immediate ejection was a possibility due to the aircraft fire indications. The HF transmitter was inoperable.

The decision to execute the 360° turn could be second guessed. At the time the SOF asked for more time for runway foaming, we had not experienced any new indications of aircraft fire, and I felt the chances of a successful recovery would be improved if the runway were foamed.

As the emergency progressed we discussed the option of ejecting. The question was which alternative represented the lesser risk to life and property; ejection, with the attendant risk to the semi populated community below, the non-zero risk of injury to the crew during the ejection, and the certainty of loss of the aircraft versus non-ejection with its obvious hazards. In the final analysis, the foam was about 8 miles ahead, the airplane was still flying well and our judgment was that attempting the landing represented the minimum overall risk.

The flight control problems that developed during final approach were most probably caused by decreasing hydraulic pressure from the remaining pump.

The overall command control during this emergency was good, and I feel the SOF did an excellent job of coordinating the recovery.

In conclusion, I feel that when an aircrew is faced with a compound emergency, a thorough knowledge of the Dash 1 is indispensable. The checklist has the procedures for just about every system malfunction that can be expected; however, it's the crew's in-depth knowledge of how these systems interrelate that makes the difference between a recovered or a lost aircraft. ★

Twenty minutes after first fire indications, the author landed burning F-111 on foamed runway. Foam extinguished the fire and the crew egressed safely.





ABOUT THE AUTHOR

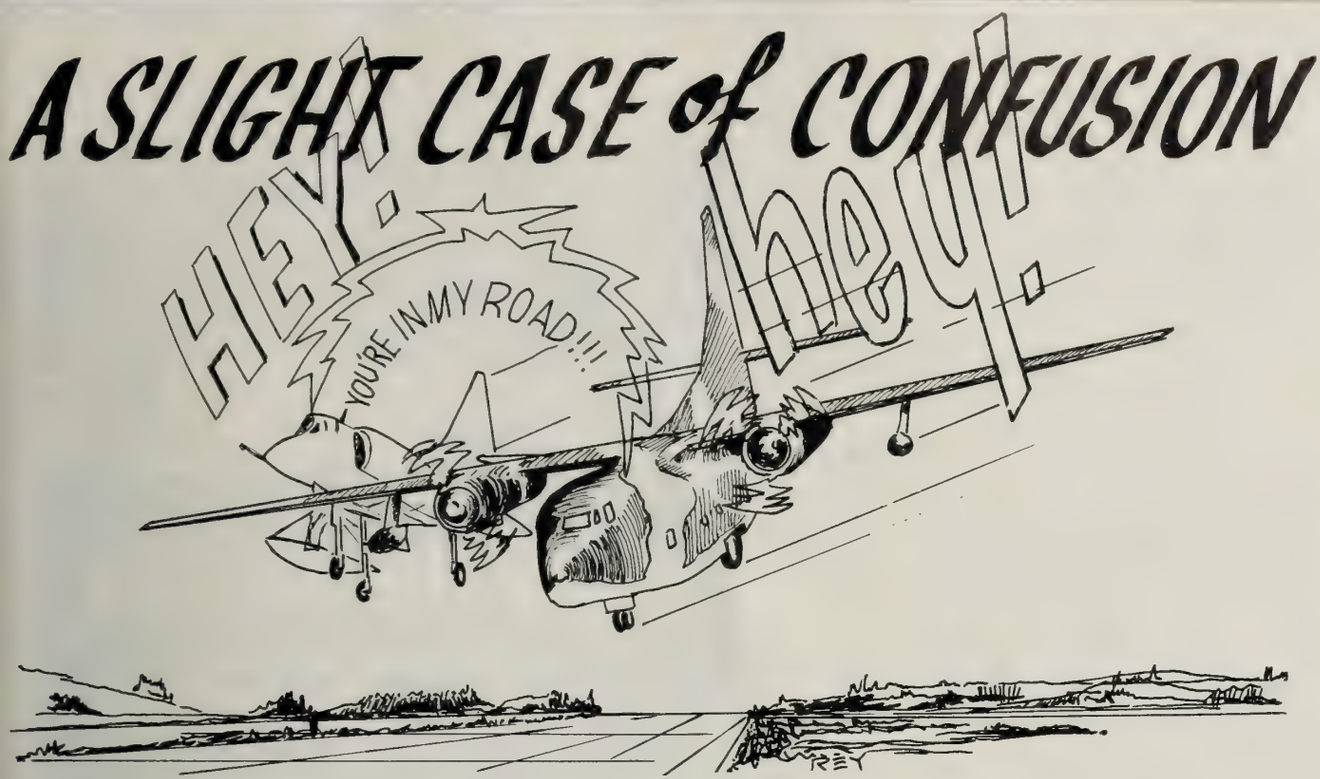
Captain Victor G. Grahn is a Standardization/Evaluation pilot, 27th Tactical Fighter Wing, Cannon AFB, New Mexico. He was commissioned through the ROTC program in 1966, and entered pilot training at Williams AFB, Arizona, in February 1967. Following pilot training, Captain Grahn was assigned to the 604th Air Commando Squadron, Bien Hoa Air Base, Vietnam, where he flew 334 combat missions in the A-37A.

From Vietnam, Captain Grahn was assigned to Laredo AFB, as a T-38A instructor pilot. In 1972, he was assigned to Cannon AFB, to fly the F-111D. While at Cannon AFB, Captain Grahn became the first pilot to log 1,000 hours in the F-111D and also the first pilot to log 1,000 hours of IP time in the D model.

Captain Grahn was recently awarded the "Aviator Valor Award for 1976" for this incident.

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A SLIGHT CASE of CONFUSION



Recently a hazardous air traffic report was filed as the result of a mixup in communications, aircraft identification, and a declared emergency. Although the situation was rather unique, the safety implications are such that the incident deserves wide dissemination.

The principals involved in this scenario were an A-4E, call sign Shark 17, and an Air Force C-123, call sign Pawk 17. While on a local training flight out of NAS Memphis, the pilot of the A-4 was informed that the field had gone below minimums. He executed a missed approach and requested divert to Blytheville AFB. After being informed by Memphis Approach that the weather at Blytheville was below landing minimums, the pilot requested a climb to FL260 and vectors to Little Rock AFB.

Memphis Approach cleared Shark 17 to climb to 9000 feet and to contact Memphis Center for further flight following. When he contacted Memphis Center, the pilot again requested a higher altitude and vectors to Little Rock AFB. At this time, he informed the Memphis controllers that he would be declaring "emergency fuel" upon arrival at Little Rock AFB. Memphis Center approved any altitude the pilot wanted.

Approximately 50 miles east of Little Rock AFB, Memphis Center instructed Shark 17 to descend to 9000 feet at pilot's discretion and contact Little Rock Approach Control. Little Rock Approach then received Shark 17 as a "handoff" from Memphis Center.

Meanwhile, the pilot of Pawk 17, the C-123, on an IFR flight plan to an Ohio destination and on the same Memphis Center frequency as Shark 17, heard the frequency change instructions for Shark 17 and thought they applied to him. Little Rock Approach received contact from Pawk 17 and confused the call sign with Shark 17 as they issued instructions to descend to 2000 feet for vectoring to final approach course to Little Rock AFB. Pawk 17 immediately replied thanks but he wasn't interested in landing at Little Rock since his destination was in Ohio. Little Rock Approach then issued instructions to Shark 17 to immediately climb to 10,000 feet and contact Memphis Center for further flight following. (Readers, stay with us; we may get this cleared up yet!).

Shark 17 (the real one) heard these instructions and informed Little Rock Approach that he was "emergency fuel" and wanted an immediate descent for a precision approach to Little Rock AFB. Meanwhile, Little Rock Approach Control and Memphis Center were coordinating to eliminate the confusion. Finally, the light bulb blinked on, and both Approach Control and Memphis Center realized they were handling two different aircraft with two similar-sounding call signs.

The primary reason for the call sign confusion was from their similarity in sounds and the fact that Pawk 17 replied to instructions issued to Shark 17. This confusion was further compounded in that Approach Control only had a "flight following strip" on Shark 17. When the confusion was finally straightened out, Shark 17 was 1 mile out on final approach to Little Rock AFB at 9000 feet. He subsequently landed safely, and although not mentioned, it is presumed that Pawk 17 flew happily and somewhat wiser on to his Ohio destination.—Courtesy US Navy *Weekly Summary* No. 21-77 (15-21 May 1977). ★



KNOW THE NATIVES

SRA WM. DAVID GOODRUM
Operations and Requirements Branch
3636th Combat Crew Training Wing
Fairchild AFB, WA

"All of us see through the lens shaped by our own culture. A web of culture binds us to a style of life, to a moral order and a definition of human nature. We see, understand, and make judgments based on the codes and values we grow up with.

"Folklore, art, religion, technology, and social order reflect the way a person comes to terms with life. Each culture embodies an experiment in human potential. Each culture stands as a monument to man's achievement, and each testifies to the human capacity to find a formula for survival."

(Vanishing Peoples of the Earth, *National Geographic,* Matthew W. Sterling, PhD)

This summarizes what many military people continually experience in their travels—that people around the world are culturally different. However, we seldom realize that cultural diversity is normal and in no way reflects inferiority or superiority.

Here at Fairchild AFB, Air Force personnel learn a number of basic survival techniques and procedures. To most of you, "survival" probably conveys a picture of a person or group of people alone in the wilderness. However, in many cases (especially in our ever-expanding civilization), the survivor must be familiar with different cultural groups' customs and beliefs, to communicate effectively, and survive, among his possible rescuers.

Of course, you can't know everything about different cultures worldwide, but you can learn and remember some basic truths about dealing with people everywhere.

RESPECT THEIR CULTURAL BELIEFS AND CUSTOMS

Learn to deflate your own prejudices through knowledge and research. Because other people are different doesn't mean they're inferior. Remember, as a survivor, you probably aren't going to be in a position to be demanding anything. In all likelihood, you'll be in dire need of assistance, and once you insult a man's heritage or culture, you cannot recant. Whether inadvertent or not, an insult with no attempt to apologize can be hazardous. An attempt to apologize is usually appreciated; however, minor insulting behavior is usually accepted as typical of an unknowing stranger. Showing interest in people and respect for their customs will more than compensate for inadvertent mistakes.

ACTIONS SPEAK LOUDER THAN WORDS

In many cultures, outsiders are judged more by what they *do* than by what they *say*. Your actions may well determine whether you will be accepted or ostracized by your possible rescuers. For example, the Bedouin peoples of Saudi Arabia consider it an affront to their honor if you display the soles of your feet while sitting. In addition, the right hand is used exclusively for eating, drawing, or greetings.

In South America, many people will take offense at our A-OK sign with the index finger and thumb forming a circle (see picture). It is analogous to our displaying the middle finger in anger.

The people of Asia and the Far East consider bowing to be an honorable and respectful greeting between equals, not an indication of inferiority as many Americans believe. The list of physical sign lan-

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guages is enormous. In stating these examples, we are not saying that you should subscribe entirely to your hosts' cultural beliefs, but that you must respect and tolerate cultural differences. Your best source of on-site information is to carefully watch the local peoples' body language and actions, and then make an attempt to mimic them. But do it with respect for their society.

KEEP YOUR PROMISES

In many cultures of the Middle East, your promise is comparable to a written legal contract. The spoken word, in many instances, is all a society may rely on for legal harmony within the group. If one member of the group should renege on a promise, he is ostracized, and without the group's assistance, his immediate survival is placed in jeopardy. A member's discourtesy or dishonesty may also affect the entire group's survivability. The group's contacts and relations with other interdependent groups may be severed or weakened through a poorly conducted transaction. Therefore, the ramifications of an insincere promise may be life-threatening.

BE PATIENT

Patience is another essential virtue in cross-cultural contacts. Other people may do things in a completely different manner than you may expect. Don't become anxious and assume you will receive immediate remedies to your probems. Patience will aid you much more than being impetuous.

KEEP A STIFF UPPER LIP

To survive among people, you must also maintain a good attitude and conceal apprehension. Many people will make an outsider the focal point for abuse or jokes. As a survivor, you should show good humor even if the joke is at your expense. A case in point concerns two American PWs in Southeast Asia. They were incarcerated together in very primitive surroundings near the battle area. The enemy was continually ridiculing them—spitting, cursing, etc. They were given food, which consisted of rice and gruel, and chopsticks as eating utensils. One of the prisoners was familiar with the use of chopsticks and began to eat. The other looked around inquiringly and then, remembering that he should eat whatever is offered, reached down and scooped a handful into his mouth. The guards watched in amazement and then burst into virulent laughter. All their ridicule now shifted to the prisoner who ate with his hands.

The Vietnamese consider eating with their hands as uncivilized. The Macaque monkeys they kept as pets ate with their hands and the captors related the prisoner's actions with those of their monkeys. This caused the man who was unfamiliar with chopsticks to wonder if his fellow prisoner might have collaborated with the enemy, resulting in dissension and distrust between the two prisoners. All of this was caused by the chopsticks and could have been avoided through prior knowledge. If the second prisoner could only have known more about his enemy's culture and habits, he could have alleviated many unnecessary abuses.

Training and research before exposure are the most available and factual means of becoming more sophisticated in your dealings with other peoples. The 3636 CCTW's Environmental Information Division (EID) at Maxwell AFB, Alabama, has published many informative cultural briefs and studies on people worldwide. Your own information library may have Ethnic cards with concise, informative outlines of the basic physical characteristics and customs of sociological groups world wide (see picture). Also, a film in the Air Force inventory (SFP #1297, Land Survival: Ethnic Groups) displays basic techniques and procedures for establishng initial contact with native peoples. It is a 16mm, 40-minute documentary type film designed to demonstrate successful cross-cultural contacts. Although filmed in the American tropics, the principles portrayed apply worldwide. If it is not available through your film library, you may obtain this filc by writing to AAVS, Norton AFB, CA 92409.

The key to success in dealing with other peoples of the world is *you*. Successful cross-cultural contact depends upon patience and a basic insight developed through knowledge and understanding. In subsequent articles, we will give you more research sources, along with examples of cultural differences in relation to hostile territory, environment, eating habits, courtesies, transportation, and psychology of the survivor. The EID publications listed below may be ordered by writing to 3636 CCTW/DAD, Fairchild AFB, WA 99011. These documents will assist you in developing the insight needed:

ENVIRONMENTAL INFORMATION PUBLICATIONS

A-103, *Down in the North,* Analysis of Survival Experiences in Arctic Areas.

D-100, *Afoot in the Desert,* Basic Information for Survival in the Desert Regions.

D-102, *Sun, Sand and Survival,* Analysis of Desert Survival Experiences during WW II.

G-110A, *An Annotated Bibliography of Basic Survival, Combat Survival, and Counterinsurgency*

Cultural Briefs: *The Peoples of Iran, Iraq, Israel, Jordan, Lebanon, Saudi Arabia and Syria.*

Questions or comments concerning the information contained in the article should be addressed to SrA Wm. David Goodrum, Operations and Requirements Branch (DOTO), 3636 CCTW (ATC), Fairchild AFB, WA 99011 or AUTOVON 352-5470. ★

LIEUTENANT COLONEL
ROBERT L. GIORDANO
Directorate of Aerospace Safety

what is the HATR doing?



Okay, all you guys out there who have been bad-mouthing the Hazardous Air Traffic Report Program—WATCH IT!

It's taken us a year of tinkering with the computer and the data to get the program working right, but here's what it's done for us so far! ITEMS

• Hazardous Air Traffic Reports (HATRs) have identified some terminal areas where general aviation is not aware of our operations. One of the solutions that has been picked up is publication of a Terminal Area Graphic Notice in Part 4 of the Airman's Information Manual. Graphic notices show the relationship between the IFR traffic flow and the recommended VFR routing. There have been fewer near midair collisions in some of the terminal areas since publication of a graphic notice.

• A deficiency was corrected in the relationship between missed approach procedures and climbout procedures for successive instrument approaches in AFM 51-37, "Instrument Flying." Oddly enough, the basic reports and investigations did not identify this deficiency and each HATR could have been closed out with local corrective action. However, when related data were pulled out of the automated file, the root cause was identified and corrected.

• Safety advisories, i.e., traffic alert and low altitude alert, were originally only included in the radar section of the air traffic control procedures handbook. HATRs pointed out that these advisories were applicable to all types of air traffic services, not just radar. That was acknowledged by the FAA, and these advisories are now in the General Control chapter of the handbook.

• The requirement for radar air traffic controllers to monitor VFR (Mode A/3, Code 1200) squawks was unclear and was very permissive as to controllers' responsibility. HATRs pointed out that display of VFR squawks can improve radar advisory service. FAA has acknowledged this and now requires that Automated Radar Terminal System (ARTS) facilities display Mode C (altitude readout) on all untracked (VFR) targets. This should improve future traffic advisories.

• A revision of the Federal Aviation Regulation concerning taxiing on the aerodrome is proposed. Although the impetus for this action was primarily from the Tenerife, Canary Islands, collision between two B-747s, HATR data pointed out deficiencies in the regulation and were used to establish a supporting position for the proposal. As is often the case, the individual HATR may not have addressed the real problem, but collectively, they provided the data needed to help solve a larger problem.

• Aeronautical Systems Division (AFSC) has let a contract for a mid-air prevention system study. The contractor, AIRINC Research Corporation, found that HATR data and its accessibility were of great value to their efforts. We may never see the product of their study or recognize resulting changes, but the HATR data base will make a significant contribution.

Furthermore, the HATRs are providing us an interface with the NASA Aviation Safety Reporting System. Because of the thoroughness of our reports, we have been able to rebut many criticisms of military operations which would

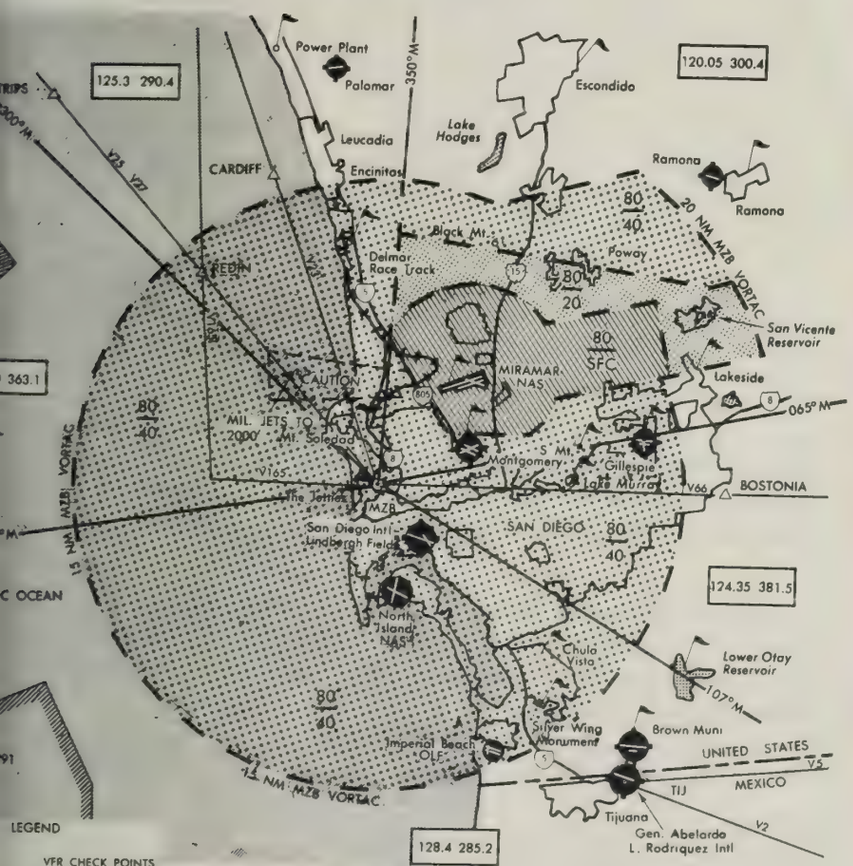
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otherwise have gone unanswered. Although you don't see this in action, we are frequently able to show NASA and the rest of the airspace users that the real problem is in the system, not in the military.

HATR summaries are published quarterly in the *USAF Safety Officers' Study Kit*. The last was in the August 1977 Kit; the next will be in the November 1977 Kit. Visit your FSO and you can follow the progress of the program in the summaries which include more detail than we have presented here. You may even recognize the reference to one of your HATRs. We appreciate your inputs to the program—aircrews, air traffic controllers, FSOs and others. As the data base grows, and we become more proficient in how to use it, system deficiencies can be recognized and corrected before they result in a mishap.

So—keep those Hazardous Air Traffic Reports coming in folks. The system works, and it's doing us some good. ★

SAN DIEGO, CALIFORNIA
MIRAMAR NAS
FIELD ELEV. 477'MSL



Prepared by the National Ocean Survey
at the direction of the
FEDERAL AVIATION ADMINISTRATION

16 JUN 1977

REX RILEY
Transient Services Award

LORING AFB	Limestone, ME
McCLELLAN AFB	Sacramento, CA
MAXWELL AFB	Montgomery. AL
SCOTT AFB	Belleville. IL
McCHORD AFB	Tacoma. WA
MYRTLE BEACH AFB	Myrtle Beach, SC
EGLIN AFB	Valparaiso, FL
MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
MARCH AFB	Riverside, CA
GRISSOM AFB	Peru, IN
CANNON AFB	Clovis, NM
LUKE AFB	Phoenix, AZ
RANDOLPH AFB	San Antonio, TX
ROBINS AFB	Warner Robins, GA
HILL AFB	Ogden, UT
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, NC
ENGLAND AFB	Alexandria, LA
KADENA AB	Okinawa
ELMENDORF AFB	Anchorage, AL
PETERSON AFB	Colorado Springs, CO
RAMSTEIN AB	Germany
SHAW AFB	Sumter, SC
LITTLE ROCK AFB	Jacksonville, AR
TORREJON AB	Spain
TYNDALL AFB	Panama City, FL
OFFUTT AFB	Omaha, NE
McCONNELL AFB	Wichita, KS
NORTON AFB	San Bernardino, CA
BARKSDALE AFB	Shreveport, LA
KIRTLAND AFB	Albuquerque, NM
BUCKLEY ANG BASE	Aurora, CO
RICHARDS-GEBAUR AFB	Grandview, MO
RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH
CARSWELL AFB	Ft. Worth, TX
HOMESTEAD AFB	Homestead, FL
POPE AFB	Fayetteville, NC
TINKER AFB	Oklahoma City, OK
DOVER AFB	Dover, DE
GRIFFISS AFB	Rome, NY
KI SAWYER AFB	Gwinn, MI
REESE AFB	Lubbock, TX
VANCE AFB	Enid, OK
LAUGHLIN AFB	Del Rio, TX
FAIRCHILD AFB	Spokane, WA
MINOT AFB	Minot, ND

OPS TOPICS

NEGATIVE MEANS NONE

Sometimes the terms pilots use to report wind shear lead to misunderstanding. When a pirep reports "negative wind shear" the usual interpretation is no wind shear encountered. However, some pilots have been using the terms negative wind shear to describe a loss of airspeed or lift. The preferred method of wind shear reporting is to state the loss/gain of airspeed and the altitudes at which the shear was encountered. An alternative method of reporting is to state altitude of occurrence and effect on the aircraft, e.g., "abrupt wind shear at 800 feet on final, max thrust required."

Even if pilots report wind shear accurately, it is worthless until it is relayed to other pilots. So controllers must accurately pass on such reports (include the reporting aircraft type, also).

HYPOXIA

A C-130 was departing on the final leg of a mission in Europe with seven crew members and eleven passengers. As the aircraft approached FL 220, the pilot in the left seat noticed the onset of hypoxia symptoms and checked the cabin altimeter; it read 17,000 feet. After landing, the bleed air inline filter to the outflow valve in the pressurization system was found to be clogged. This obstruction restricted the airflow to the differential control system in the cabin pressure controller. In effect, it indicated to the pressurization system that the aircraft was overpressurized.—Major John D. Woodruff, Directorate of Aerospace Safety.

BAN ON WEAPONS AT AIRPORTS PROPOSED

The Federal Aviation Administration has proposed a rule that would make it a federal offense to carry an illegal weapon into an airport terminal.

FAA said the ban on firearms and other weapons is being proposed because they continue to be detected at airport screening points in alarming numbers, although present screening requirements have been in effect for more than 4 years. In the last 6 months of 1976, for example, 2,840 firearms—including 859 handguns—were detected at airport screening points throughout the nation.

Existing FAA regulations make it a federal offense to carry weapons aboard an aircraft but do not prohibit persons from bringing them into the terminal. And the agency noted that many of those detected carrying weapons in airports have not been airline passengers but were persons who went through the screening points when meeting or seeing-off passengers. These individuals were subject to prosecution under local gun control laws but not under federal law.

The proposed rule would not apply to firearms inside luggage that is to be checked to the passenger's destination. It is legal to carry such weapons in checked luggage as long as they are unloaded, the luggage is locked and the passenger has the only key, and the passenger informs the airline that the luggage contains a weapon.

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OPS TOPICS

UNSAFED PINS

When the pilot in the front seat of an F-4 opened his canopy, the rear seater saw the pin bag with the ejection seat safety pins fall over the left canopy rail and back into the engine intake. Despite immediate shutdown of the engine, all stages of the compressor were damaged. The pilot had stowed the pin bag in the thermos bottle holder. He did not use the map case because it was filled with maps and approach plates.

The mission included some instances of zero and negative G flight. Neither crew member noticed the pin bag move but, since it was not secured to the thermos holder, it probably moved up and became lodged against the canopy rail or ejection seat. Thus, when the canopy was opened, the bag fell free.

AIRPORT QUALIFICATION PROGRAM

In the January issue we wrote about the new airport qualification slide tape presentations being developed. There are now 25 of the presentations complete on bases from Norton to Dakar to Kaneohe Bay. Check with your film library for a complete list.

FOLLOW THE YELLOW BRICK ROAD?

An F-4 loaded for a live ordnance mission was parked in a TAB VEE shelter. The clearance upon taxiing out of the shelter is critical, so all aircrews were briefed to adhere closely to the yellow taxi lines for exit. In this case when the crew was ready to taxi they saw two taxi lines emanating from the shelter. They picked the one they could see the best and started to taxi. The crew chief seeing the nose gear centered on the line cleared the aircraft to continue to taxi.

Just after the aircraft started a left turn, the WSO saw that the right wing tip clearance was decreasing. Although he warned the pilot, there was not sufficient time to stop before the wing struck the wall. When the taxi lines were painted, one line (the one selected by the aircrew) was incorrectly positioned. A new line had been painted but the old one had not been marked out or covered. Thus, the crew falsely assumed that either line was O.K.

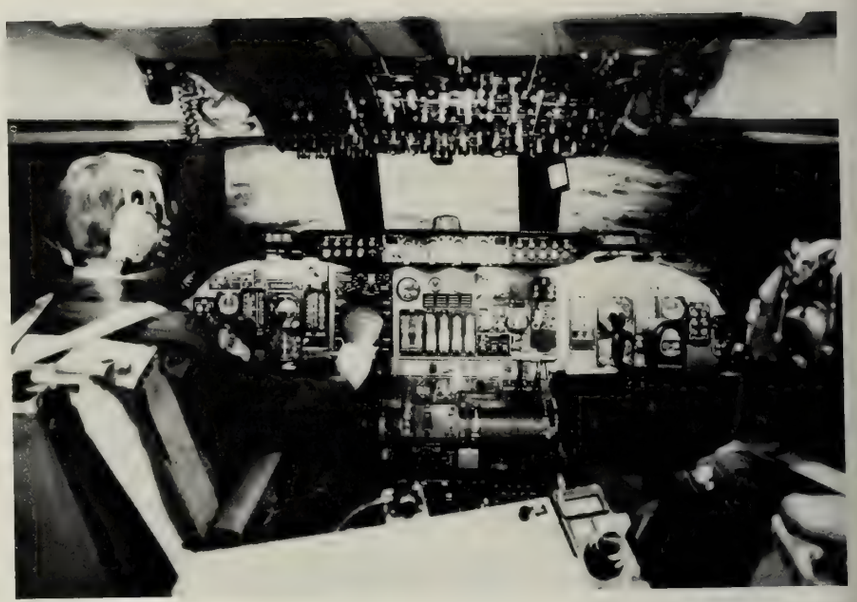
AN INCH IS A LOT

When an HC-130 pilot asked for the current altimeter setting, he was given 30.31. However, the true setting should have been 29.31. The 1-inch error was due to an incorrect entry by the weather observer on the telautograph. Fortunately, the crew of the HC-130 was pretty sharp and they questioned the altimeter setting. After several queries, the error was discovered, and the crew got a good altimeter setting.

DON'T HELP MURPHY

During an ejection, a pilot lost his life because his survival equipment, which he had hooked up improperly, prevented proper operation of his parachute. Your egress and survival gear will function as designed if it is properly installed and operated. Mr. Murphy wins enough, don't stack the deck against yourself by not using your survival gear properly—Capt Michael T. Farson, Directorate of Aerospace Safety. ★

USAF IFC APPROACH



APPROACH MONITORING

Q. When can a pilot expect to reveive a radar monitored approach?

A. Any approach can be monitored by Precision Approach Radar (PAR) if the final approach course of the instrument approach procedure to be flown coincides with that of the PAR from the final approach fix to the runway. When one of the following conditions exists, PAR monitoring is mandatory:

1. The reported weather is below basic VFR minima (1000 feet and 3 miles),
2. At night, or
3. Upon request of the pilot.

Also, all simultaneous ILS approaches will be monitored by Airport Surveillance Radar (ASR), regardless of the weather conditions, to ensure lateral separation between aircraft on parallel courses.

Q. When being monitored on a nonprecision approach, what information can I expect to receive? What about ILS?

A. Prior to beginning final descent, a pilot executing a non-precision approach will be advised that glide path advisories will not be provided. The pilot should also be informed when he passes the final approach fix (FAF). On all approaches, course trend information will be provided (with respect to the PAR azimuth cursor) when the aircraft position is well left or well right of course and whenever the radar safety limits are exceeded. Glidepath trend information is provided for ILS approaches only. It consists of aircraft position reports in respect to the PAR elevation cursor, when the aircraft is well above or below the glidepath and whenever it exceeds the radar safety limits. The position of the aircraft in relation to the course and to the area above the glide path is a judgment call by the controller. The only safety limit normally displayed on his radar scope is the lower safety limit for the glide path.

Q. How does a pilot know when he has exceeded a radar safety limit?

A. The controller will advise the pilot of his position with respect to the glidepath and/or course. Then the controller will inform the pilot that if he is unable to proceed visually, he should execute a missed approach. If sufficient visual cues are available for the pilot to continue the approach without the need to refer to his navigation instruments, then he may continue and land. If not, a missed approach should be executed.

Q. When will the controller discontinue providing approach monitoring information?

A. For other than simultaneous ILS approaches, approach monitoring information will be given until the aircraft is over the landing threshold or commences a circling approach. Normally, monitoring of simultaneous ILS approaches will be discontinued at one mile from the landing threshold.

ENROUTE DESCENTS

Q. When can a pilot expect an enroute descent at his destination?

A. At any time. Normally, unless a pilot requests otherwise, Air Traffic Control will give an aircraft an enroute descent upon arrival at destination. This practice enables the controller to handle aircraft more efficiently, thus increasing traffic flow and saving fuel.

Q. What type of approach can I

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expect to receive upon arrival at destination?

A. Usually the controller will give you a precision approach, if one is available. However, you can request any approach you desire to fly. Factors such as active runway, navaid status, amount of traffic, etc., will determine if the controller will issue you a clearance to fly the approach you desire. If you must fly a specific approach because of equipment malfunctions or lack of certain navaid receivers, advise the controller as soon as possible after initial contact to aid him in planning ahead, to assure you receive the necessary services.

Q. As an F-4 pilot, should I expect to receive clearance for an approach published in the high altitude terminal publications, whenever I am given an enroute descent?

A. Yes, unless you are being given an ASR or PAR approach. Single-piloted turbojet aircraft, such as the F-4, A-7, T-38, F-111, F-15, etc., may expect to receive clearances for procedures published in the FLIP Terminal High Altitude Approach booklets. In addition, when the enroute descent is conducted via a non-radar routing, the clearance received by the pilot should only include those navaids/fixes depicted on the appropriate high altitude approach publications.

Q. May a single-piloted turbojet aircraft fly a low altitude procedure after receiving an enroute descent?

A. Yes. If you want to fly a low altitude procedure, request it from the controller prior to beginning the enroute descent.

RADAR PROCEDURES

Q. What and where is the "Approach Gate?"

A. The "Approach Gate" is an imaginary point located on the final approach course. It is used by the radar controller as a reference point for vectoring aircraft so they will intercept the final approach course at least one mile prior to the final approach fix or five miles from the landing threshold, whichever is farther from the landing threshold.

Q. When being radar vectored to the final approach of an instrument approach procedure, where should an aircraft intercept the final approach course?

A. When the reported weather indicates a ceiling of at least 500 feet above the minimum vectoring altitude and the visibility is at least three miles, a controller should vector the aircraft to intercept "final" prior to reaching the approach gate. Any other time, final interception should occur at least two miles outside the approach gate.

Q. Will an aircraft ever be vectored to intercept the final approach course closer to the runway threshold than the approach gate?

A. Yes, but only if the pilot requests a shortened final approach. Even then, the aircraft will not be vectored to intercept final any closer to the threshold than the final approach fix.

Q. At what altitude should the final approach course be intercepted?

A. For precision approaches, at an altitude which will allow the aircraft to intercept the glide slope from below. In the case of a non-precision approach, at an altitude which will allow descent in accordance with the published procedure.

Q. What is the maximum intercept angle that should be used by a controller when vectoring an aircraft to final approach course?

A. When the distance from the final approach course interception point to the approach gate is less than two miles, then the maximum intercept angle is 20 degrees. When the distance is more than two miles, then the maximum intercept angle is 30 degrees for fixed-wing aircraft and 45 degres for helicopters.

Q. When being vectored to final, should a pilot initiate a turn onto the final approach course without being issued an approach clearance?

A. Even though the controller is responsible for advising the pilot if he is to be vectored through the final approach course, the pilot should continue to maintain his last assigned heading unless he has determined that he has experienced lost communications. If you can still hear the controller transmitting, continue flying the assigned heading, unless you determine it is unsafe to do so. In any event, attempt to contact the controller and either request his intentions or advise him of the actions you have taken.

We appreciate the interest shown in the consolidated "USAFIFC Approach" article booklet. We still have plenty of copies if you haven't received yours yet. For a copy of the booklet, call AUTOVON 487-4276/4884. ★

If everyone could take five minutes a day to think of a safer way to fly, possibly half the USAF accidents would never occur.

The Old Pro

Mail & Miscellaneous

Send your ideas, comments, and questions to:
Editor, Aerospace Magazine
Norton, AFB, CA 92409

A HOT COMPLAINT

Approximately three hours out, a lady passenger approached the steward complaining that her purse was getting very hot. It was discovered that a 9-volt battery in her purse was generating the heat and smoke was coming from the battery. An oven mitt was used to remove the hot battery from the purse so it could be placed on the front galley to cool. The lady then removed some coins, that were quite hot to touch, from the same section of her purse. Apparently the passenger had removed the battery from her portable radio but unwittingly dropped it into the section of her purse containing the coins. The battery was shorted. The manufacturer of the particular battery stated that a fresh 9 volt battery shorted by a coin could easily produce sufficient heat to cause a fire or the battery itself could explode.—Courtesy **British Airways Air Safety Review,** May '77.

GROWN UP & EDUCATED

While going through an old diary of mine I came across a note on an incident which took place some years back.

I have reproduced the details and am forwarding herewith as a manuscript for your esteemed magazine.

I hope it may be of some interest to you.

"Some years back I was responsible for transient maintenance on an air force base. One day a USAF C-135 aircraft landed for in route maintenance. I detailed the party to help the aircraft crew-chief and was standing by.

"The crews and the passengers disembarked from the aircraft and went to have a snack or rest in the passenger lounge. I saw a little child of about 5-6 years of age —he must have grown up into a MAN now, impatiently looking for something. I approached him and asked if I could help him, thinking that some persons feel very uneasy to relieve themselves at higher altitudes and he may be looking for W.C. First he hesitated and then replied that he had some candy wrappers in his pockets and was looking for TRASH CAN to dispose them off. To know his reactions I told him that there is no harm if he threw them on the flight ramp here itself. No sir, it is no good. It will make the place dirty and I won't like to do that. I showed him the TRASH CAN and he emptied his pockets there. Thanking me he left the place.

"It was very pleasing to get such an answer from so small a lad. This is the UP BRINGING—the way he had been brought up.

"Every day we see people who knowingly throw cigarette ends and other trash all over the places. Some of these cigarette ends have caused BIG FIRES. Metallic articles have damaged tires of aircraft and vehicles or blown to the flight ramp to be picked up by jet engines causing FOD (Foreign Object Damage). These are the few examples.

We are grown up and educated!"

The incident took place in May/June, 1965 at Masroor AFB, (Karachi), Pakistan.

M. Abbas A. Ovaisi
ex Master Warrant Officer
Pakistan Air Force
Dezful - Iran

MEMORIES

The "Name That Plane" picture of the B-18s in your June edition of **Aerospace Safety** brought back memories from a bygone era. As a teen-aged enlisted man I flew in the B18A with the 41st Reconnaissance Squadron at Langley Field, Virginia before WW II. You pictured No. 4 assigned to the 18th Reconn Sq as lettered on the nose and tail section. Some other recollections: The pilot's cabin was carpeted and I remember doing my share of vacuuming the cabin. However, the aft section was a cold, uncarpeted place. During high altitude bombing practice we sucked oxygen hoses because face masks were not in use at the time. Armament included a flexible .30 cal machine gun in the rear mechanically operated turret and another in the ball of the nose section.

One incident I recall occurred when I flew for the first time as a nose gunner. The pilot was our squadron operations officer, Capt Curtis E. Lemay (later Chief of Staff). Upon firing my first burst, the tow target immediately collapsed and fluttered away. I was scared skinny at what Capt Lemay might say after all the preparation it took to get the mission set up. Of course, when told what had happened he showed no emotion, but gruffly called up the tow aircraft to put another sleeve target out on the cable. After that I took better aim!

Later, we took a giant step forward when our B-18s were replaced with six B-17Bs from the Second Bomb Group.

I would like to take this opportunity to let you know how much I have enjoyed your publication over the years—both as **Flying Safety** and as **Aerospace Safety.** Your excellent articles are highly instrumental in maintaining an efficient, professional force. Keep up the good work!

Lt Col Art Herman
432nd Tactical Drone Group
Davis-Monthan AFB, AZ

HOT REFUELING

I was very interested in reading your article about hot refueling in the April 1977 issue of **Aerospace Safety.** As an Aviation Safety Officer of a Marine F-4 squadron, my interest in this type of operation has been intense. I was particularly impressed with the use of pneumatics for control in place of electricity. I am making an effort to convince the Navy/Marine Corps of the safety aspects of this system of control.

The one feature that appears to be lacking in the USAFE system that has proved invaluable to us Marines has been a large, easy to read counter that indicates the quantity of fuel that is being delivered to the airplane. This has proved to be invaluable to the pilots in that they can cross-check the aircraft's fuel indicating system to the fuel pit system, ensuring a complete fuel load in external fuel tanks and adding a safety measure to a somewhat hazardous operation. ★

Capt D. C. Cullison, USMC
H&MS-24 MAG-24
MCAS Kaneohe, Hawaii

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LT CMDR HARRY W. HARTSELL, USN

3246th Test Wing

Eglin Air Force Base, Florida

On 7 February 1977 Lieutenant Commander Hartsell, a Navy exchange officer, flew a T-38 photochase mission of an F-111 weapon drop over the Gulf of Mexico. While flying at 1000' AGL, 575 KCAS, he noticed the right fire warning light was illuminated. The F-111 crew notified him that white smoke was trailing from the T-38. He retarded the throttle to idle and, although the light extinguished, smoke remained. A few seconds later the right warning light came on again, then—the left fire warning light. He shut down the right engine, retarded the left throttle to idle, and initiated a zoom climb towards Eglin. Next he shut down the left engine. Both fire lights remained on. He decided to remain with the aircraft and attempt one airstart, choosing the left engine because it had maintained normal instrument readings. It started and smoke was no longer visible. Lieutenant Commander Hartsell made a single engine, straight-in approach and landing. The fire had burned through the right stabilator control rod and burned the stabilator trim wiring causing unusually heavy stick forces during the approach and landing. On the runway, he shut down the left engine and battery, and ground egressed. An examination of the aircraft revealed the fire was caused by a crack in the right combustion case that burned the right engine oil servicing line, igniting an oil fed fire that burned through the left engine compartment. Lieutenant Commander Hartsell's calm, accurate assessment of this critical emergency coupled with his professional airmanship prevented the loss of a valuable aircraft. WELL DONE! ★

September 18, 1947–1977



Last month we featured an article, 70 And Going Strong, *which described the birth of military aviation in this country. The covers this month salute the 30th anniversary of the US Air Force as a separate military entity. Our display contrasts an SR-71 pilot's helmet and the leather helmet and goggles still used in 1947 along with some shoulder patches from that era and various kinds of wings.*

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THE AIR FORCE
ENTERS A NEW AGE



First Lieutenant Mary M. Livingston checks the gear of a T-38 with 2nd Lt Goeffrey W. Jumper. One of the first ten women pilots to graduate from UPT, she has been assigned to Columbus AFB, MS, as a T-37 IP.

OCTOBER 1977

UNITED STATES AIR FORCE

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

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NAME THAT PLANE

SEVERSKY P-35

The P-35 was the first Army production single-seat fighter equipped with retractable gear. The P-35 was almost 50 mph faster than the P-26. However, the one .30 and one .50 caliber gun armament was too light to keep up with the rapidly developing bombers. Built by the Seversky Company which became Republic shortly thereafter, the P-35's did not see combat but served as trainers or mechanics' mockups. This ignominious fate was absolved by the P-35's grandchild, the P-47 Thunderbolt.

Specifications—P-35
Engine—950 hp P & W R-1830-9
Span—36' 0"
Length—25' 2"
Gross wt—5599 lbs
Speed—280 mph at 10,000 ft

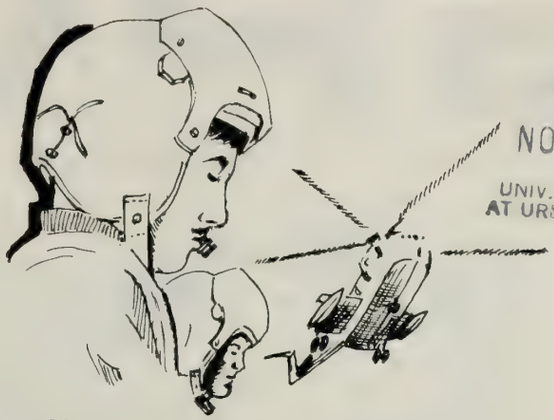
DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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OCTOBER 1977 AFRP 127-2 VOLUME 33 NUMBER 10

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news for crews



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AT URBANA-CHAMPAIGN

MAJOR WALTER CONNALLY, Rated Officer Career Management Branch AFMPC

THE USAF HELICOPTER PILOT FORCE

To many rated officers, a helicopter is associated only with a survivor/rescue situation. The following article provides a synopsis of the helicopter force and its demanding mission.

Historically, the helicopter force has been small compared to the total Air Force rated resource. During the Southeast Asia time frame, the helicopter force underwent a transition in weapon systems, roles and missions, and number and type of pilots. New turbine powered helicopters entered the inventory which provided increased range and lift capability. At the same time, helicopter instrumentation was improved and helicopters were utilized in more diverse roles and missions. Post Southeast Asia has found the helicopter force diminishing. Currently, the Air Force has helicopters and helicopter pilots assigned to six major commands (MAC, TAC, AFSC, USAFE, ATC, and PACAF). These commands fly H-1s, H-3s, or H-53s and perform local and long range rescue, missile site support, midair and surface recovery, special operations, tactical air control, VIP ferry and range support missions. Presently, there are approximately 600 cockpit authorizations and, in addition to the cockpit authorizations, there are approximately 500 helicopter pilots serving in supplement, staff, AFIT, PME and ATC instructor duties.

Avenues for officers to enter helicopter pilot duties are undergraduate pilot training/helicopter (UPT/H) and rotary wing qualification training courses conducted by the United States Army at Fort Rucker, Alabama. Officers who enter UPT/H are normally new accessions to the Air Force, while rotary wing training is provided to a limited number of Air Force fixed-wing pilots who do not have major weapon system identification. Following the initial training at Fort Rucker, advanced specialized training in an assigned weapon system is provided at Kirtland AFB, New Mexico.

Air Force helicopter pilots have the same career progression opportunities as other Air Force pilots. The initial assignment is operational where the opportunity exists to upgrade to aircraft commander, instructor pilot and flight examiner. Presently, the Air Force is providing fixed-wing qualification training to the Army trained "helicopter only" pilot. This training is provided after four to seven years of aviation service in the Air Force; however, in the future this cross-training will be provided only if it is determined necessary by Air Force requirements. As Air Force requirements dictate, helicopter pilots are also considered for cross-training into other type helicopters or assignments to operational staff and support duties. They are also eligible for attendance at the Air Force Institute of Technology and professional military education courses.

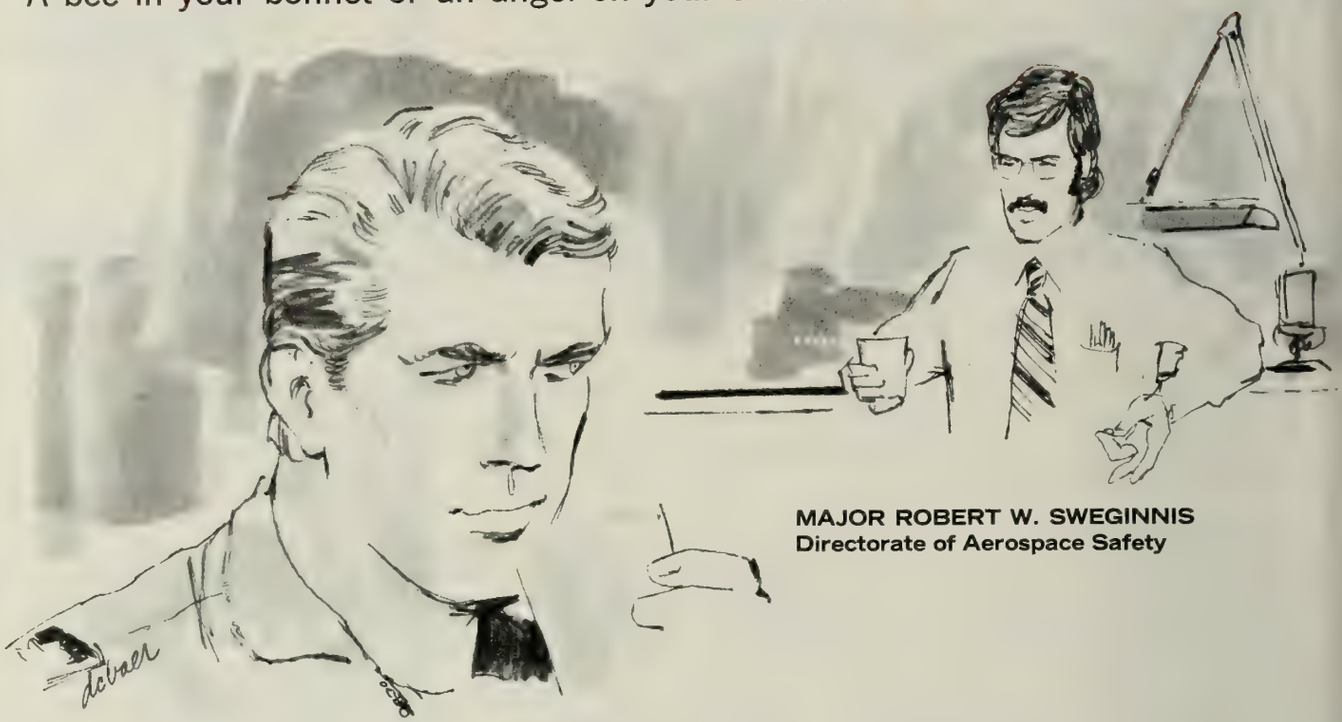
The helicopter force has undergone, and is continuing to undergo, tremendous changes; however, the opportunity exists for a challenging and rewarding career to those assigned to helicopter duties. ★

ABOUT THE AUTHOR

Major Connally is currently assigned to the Rated Officer Career Management Branch, Air Force Military Personnel Center, where he serves as the helicopter resource manager. His helicopter background includes a SEA tour in HH-43s and an assignment to Myrtle Beach Air Force Base, South Carolina, as the Detachment Commander, flying UH-INs.

GPWS

A bee in your bonnet or an angel on your shoulder?



MAJOR ROBERT W. SWEGINNIS
Directorate of Aerospace Safety

"What's this ground proximity thing you turkeys are putting into the new transport?", the veteran multi-engine driver growled as he stalked toward the program office engineer. "What are you trying to do? Drive us crazy with more flashing lights and buzzers! Don't you guys think we can hack it? Look at the record! The accident rate has been going down for years! Why don't you save the money and give us taxpayers a break? Take that cock-a-ma-my system and sho"

"Wait a minute major! Give me a chance," the engineer broke in. "I think I have some answers. Pull up a chair, fill your mug, and I'll try to explain what we have in mind and answer your questions one by one," continued the engineer as he guided the major to the coffee pot.

"First, what is this ground proximity warning system, GPWS for short, we are looking at? Basically, it picks up parameters which are already being measured, compares them, and provides three types of warnings. One type tells you when you and the ground are coming together at an unusual rate or time, another sings out when landing configuration isn't established prior to descending below some threshold altitude."

"Great, another gear warning horn," the major muttered into his coffee cup.

The engineer pretended not to hear and proceeded, "The third type of warning will inform you when you fall below the ILS glide slope."

The major's coffee cup slammed down on the desk, "Horns and red lights at minimums I don't need!"

"And you won't have them! Stay with me and I'll explain. When I said the system will tell you when the ground is coming up fast, I meant TELL YOU. Maybe we'll get some sweet young thing to record the warning, but, in any case, it will be a voice warning. And it will be specific too. If you are sinking too fast into relatively flat terrain, it would call out, perhaps, SINK RATE. If you were in relatively level flight and the terrain were rising due to hills or mountains, it could call out TERRAIN or maybe RISING TERRAIN."

"Beautiful. Every time I make a descent for an approach or fly over some hills during a low-level mission some gal is going to whisper sweet nothings in my ear," was the comment into the now near empty coffee cup.

"Agreed, that's a problem, but not an unsolvable one. Refill that cup while I get out a couple of charts."

As the major returned with another steaming cup, the old pro motioned him around the desk to look at the charts. "The first type of

warning I mentioned, you and the ground coming together too fast, has been separated by the FAA into two subsets or modes. Mode 1 compares barometric sink rate to vertical height above the terrain. The pitot static system provides the first input, the radar altimeter the second. All the GPWS has to do is compare the two; and when they get into this area," pointing to the chart marked MODE 1, "give the appropriate warning. The warning can be varied according to how far the parameters measured move into the warning area. If the threshold value is barely exceeded, a one time or low repetition rate SINK RATE may be generated. These warnings are called soft and are used around the edges of the envelope. If the height above the terrain continues to decrease with no decrease in sink rate or the sink rate increases, the repetition rate or volume could be increased. We could even change the warning to PULL UP if the time to ground collision became critical. These warnings are called hard and are used inside the envelope. The human factor folks are giving this a close look, trying to come up with the best way to alert the crew to the exact situation so they can take the best possible corrective action."

"Wake them up so they can die all tensed up, huh?!! Mind if I get another cup of coffee? Thanks. Say, how are you going to balance this thing, keep it from blabbing in my ear with useless warnings and still provide the warnings we need?"

"False warnings are a problem; too many and the crews will ignore them. Backing off on the warning thresholds, on the other hand, reduces the warning time, decreasing the value of the system. You can see the thresholds that the FAA requires for large commercial jets. The dashed lines radiating from the lower left are times to impact."

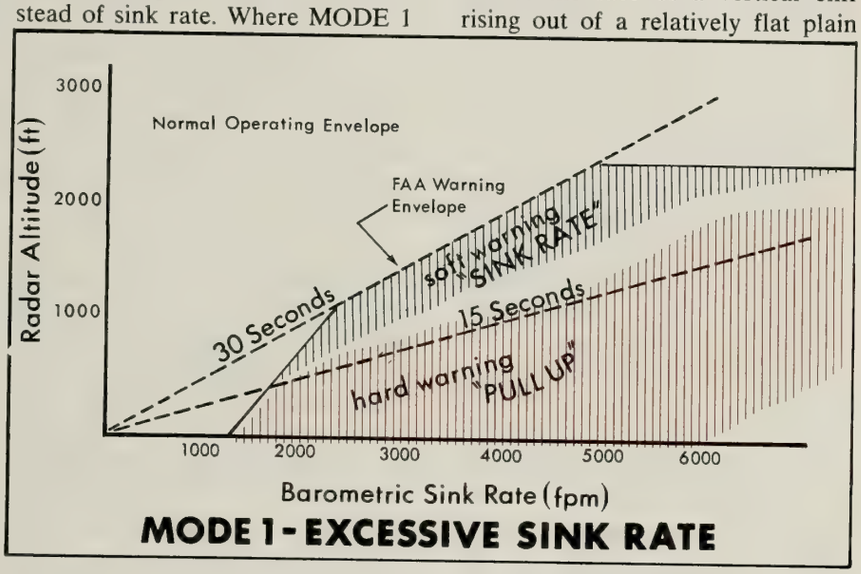
"Will these thresholds work for us?", asked the major.

"Perhaps as a starting point. But it looks like our missions are different enough to warrant significant changes. In some cases, we may have to cut back on the FAA standards to provide the flexibility we need on tactical missions. In other cases, we may be able to provide increased warning times. We are picking data points off actual test missions to ensure that we get the warning threshold as close as possible to, but not overlapping, our expected performance.

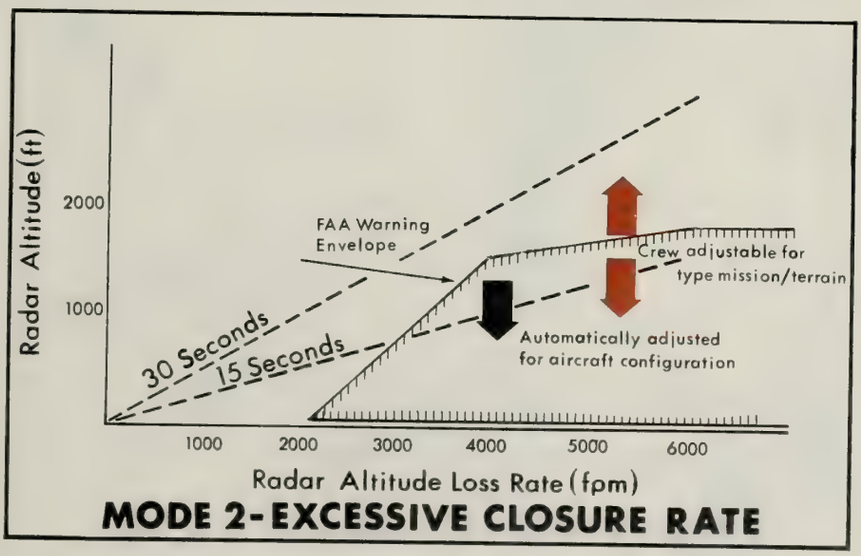
"Take a look at MODE 2. It, like MODE 1, examines how fast the gap between the ground and the aircraft is closing. But it looks at rate of change of radar altitude instead of sink rate. Where MODE 1 looks at how fast you are sinking and how much you have left to go, MODE 2 tells you that the ground is coming up to meet you fast. Different modes and warnings for different threats will allow the crew to react appropriately."

"How will a MODE 2 warning keep some crew from smacking into the side of Superstition Mountain if he's off course and in the suds?" piped up the major. "According to this chart, the GPWS only looks down and can't see those vertical cliffs. Or what about some real steep hills? You know we can't exactly climb straight up."

"True, GPWS won't keep you out of the face of a vertical cliff rising out of a relatively flat plain



MODE 1 - EXCESSIVE SINK RATE



MODE 2 - EXCESSIVE CLOSURE RATE

GPWS

continued

. . ." admitted the engineer as the major sat back with a smile, thinking he had uncovered a chink in the old man's armor ". . . but . . ." and the smile faded, ". . . when looking over past accidents, this type of accident, collision into a steep incline without any foothills, is very rare. The cost of including a forward looking radar just doesn't appear to be justified, at least for transports.

"One last thing before we leave MODE 2. Because of our tactical mission, we fly at low level a lot more often than the airlines. Since even moderately rolling hills can generate significant closure rates, a USAF GPWS may have to provide some pilot control over the altitude threshold on the upper right side of the curve. When landing configurations are established, we may want to lower the upper right edge of the warning envelope to allow for maneuvering prior to landing."

"Even if it means cutting down the warning time?", asked the major.

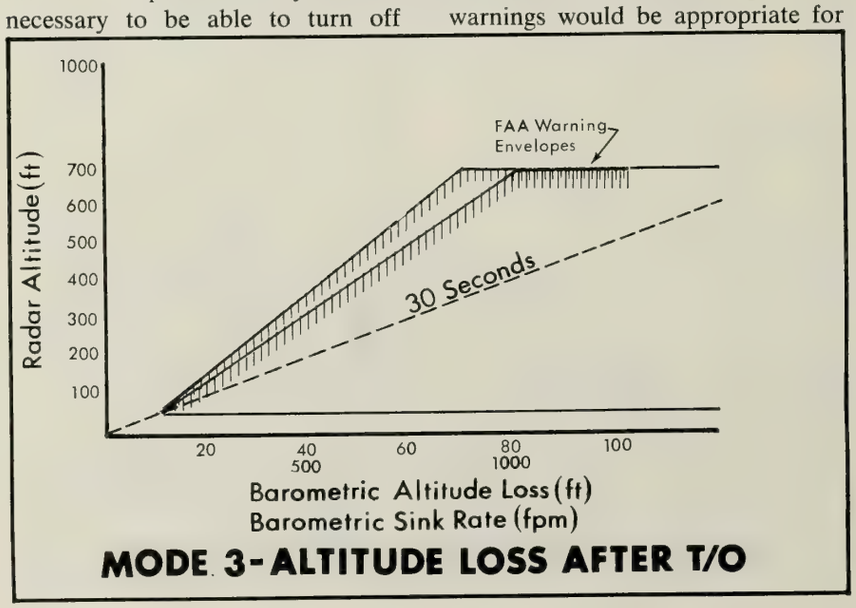
"The only alternative appears to be lots of false warnings . . . and that's unacceptable. It may even be necessary to be able to turn off some of the features. When you're VMC, you may have to occasionally fly this new machine more like a fighter than a transport. Some method of automatically resetting the GPWS will probably have to be worked in.

"MODE 3 is designed to warn of altitude loss after takeoff or missed approach. It compares altitude loss, which could be measured barometrically or with the radar altimeter, against the height above the terrain."

"Altitude above the ground comes from the radar altimeter?", asked the aviator as he reached for yet another cup of coffee. "And if I fall asleep right after takeoff, the GPWS hits me in the face with a wet sock."

"Radar altimeter is right, but you don't have to be asleep to lose visual references at night or in weather. We've also had some criticism of the old PULL UP warning which could be like a wet sock and cause problems when you're close to a stall. We're considering various voice warnings such as SINKING or TERRAIN RISING. Again, the warnings would be appropriate for the threat and correction available. MODE 4 is a bit different than the first three which all relate to absolute altitude loss. MODE 4 looks at altitude above the ground and compares it to the landing gear or flap position. When you're close to the ground, generally you want the gear and flaps down. This is the only FAA required mode that provides a ground proximity warning for all phases of flight regardless of rate of closure with the ground."





MODE 3 - ALTITUDE LOSS AFTER T/O

"Could you run that by again?", said the major, spilling some coffee as he sought a more comfortable position in the chair.

"Sure. MODE 1 and 2 require the gap between the terrain and the aircraft to be closing at over 1500 feet per minute. If you are closing the gap at something less, like 500 feet per minute . . . no warning."

"I see," echoed out the emptying coffee cup. "For a slow, steady descent, MODEs 1 and 2 are no help. And MODE 3 works only for the

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initial climb after takeoff or go-around. What about MODE 5?"

The engineer pulled another chart from the file. "MODE 5 is pretty simple. It tells you when you are falling below the glide slope. Our main questions are what kind of warning and when. The general feeling is that a soft warning be given at about one dot low. At about 3 dots low the warning would be more severe in repetition rate, volume and/or terminology. We may also vary the warnings with the height above the terrain."

Draining the last of the coffee pot, the major commented, "Tap him on the shoulder at one dot, hit him over the head at three."

"Not exactly hit him on the head, but we do want to get his full attention. For that reason, we are considering wiring all the hard warnings into the call circuit. That way it would override all other voice communications. But first we want to look closely at how this would affect crew coordination during this critical period."

"There is one other mode that I should mention. It's not required by FAA, but it is sometimes referred to as MODE 6. You're familiar with it as the radar altimeter's low-level warning index and light."

"Oh yeah, that's the light that's behind the yoke where I can't see or behind a lip where the copilot can't see it."

"I don't know about that," continued the engineer, "but with MODE 6, you will be automatically notified through the intercom when you reach whatever altitude is set on the low-level warning index. This function is really quite similar to MODE 4. Like MODE 4, it doesn't require high terrain closure rates; but, in addition, it's independent of aircraft configuration."

"So all MODE 6 will do is wire the low altitude warning light into my headset?"

As the engineer picked up and put away the charts, he nodded. "There's really nothing new in GPWS, although we do have to filter some signals and provide small delays to avoid nuisance warnings. That's true in all modes. What is different is the way we put it together and present it to the pilot. The system is there to help the crew, not annoy or distract them. This means two things. One . . . we are working to ensure that the warning thresholds are close to, but not overlapping, the operation envelope. If we miss one way, we end up with false warnings; if we miss the other way, we degrade protection. Two . . . we are trying to build a system that will not only alert the crew to the specific hazard, but one which will identify the magnitude of the hazard. Tell the crew not only which way they have to react, but how fast."

"Do you think you'll be able to make it all work?"

"I think so. The prototype flight tests have pretty much established our operating envelope . . . plus those tests we ran in the summer of '75 with commercial systems . . . now if I could get some work done around here instead of jawing with pilots and making coffee. . . ."

The major was edging toward the door but ventured one last question, "Do we really need a GPWS in this new transport; isn't it really goldplating?"

"Would you believe that 17 of the 51 C-130's destroyed in flight related mishaps since 1962 involved collision with terrain and no contributing material failure. That's one-third of our total C-130 hull losses occurring when perfectly good machines were flown into the ground. Some crashes were due to navigation errors; others resulted when crew coordination broke down or established procedures were violated. Many combined several of these factors. But the tragic fact is that during those 17 mishaps we incurred over 50 percent of our C-130 related fatalities. I'm not saying we could have prevented all of those accidents with a modern GPWS. But in almost all cases, the crew would have received a warning in time to take corrective action. That's all we groundpounders can do; the action is up to you guys. And a GPWS is a relatively cheap system. The inputs, radar altitude, vertical velocity, configuration, and all the others are already available, ready to be picked off."

"Sounds like a good investment," said the major as he stepped out the door. "Thanks for the words." ★



OPS TOPICS

IT'S THAT TIME AGAIN

On a low level training mission a C-130 had an encounter with a large bird. After the Herky landed at home the crew found a 16-inch tear in the left wing leading edge. The fall migrations are about to start so it's time to be extra alert.

BIG WIND

A C-5 at an enroute stop caused a good bit of damage to the airdrome when TRT was used for takeoff. The use of the high power setting was necessary for the aircraft gross weight and temperature at takeoff time. The blast from the engines tore up the asphalt at the approach end of the runway and damaged several of the approach lights.

Every year there are a few mishaps where people are injured or property is damaged from jet engine blast, and it is not just the big multi-engine types which are involved. Not long ago a crew chief was blown off the access step of a T-38 when the T-38 parked behind used 85 percent power to taxi out of the chocks. The message here is be aware of what the blast from your engines can do, and observe the warning distances in the Dash 1.

RUNAWAY

Two Air Force Aero Club members were preparing a Cessna 150 for an annual inspection. During the removal of the engine cowling, one of the maintenance men turned the propeller counter-clockwise through two complete revolutions. This was for ease of movement during the removal of the cowling. After the last turn the engine started. The door to the 150 was locked, and before the man with the key could get it out and open the door, the 150 jumped the chocks and ran into the tail of another aircraft parked in front of it.

Investigators found that the ignition switch of the 150 was off and the key was removed. However, the mixture control was set at full rich and the throttle was open about ¼-inch. The aircraft had not been flown recently and radio maintenance had been performed.

The final link to the puzzle was a broken ground wire on the nr 2 magneto. Thus the magneto was hot, and when the prop was pulled through, the engine started. The club inspected other aircraft and found another with hot magnetos, this time from a faulty ignition switch.

HOLD IT

A C-130 was on a local training mission with two new copilots on their first ride after UPT. The IP was flying the aircraft while the students were making a seat change. Things were a bit busy in the cockpit since the aircraft had just completed a low approach and received clearance to the outer marker southwest of the airfield.

Then Approach Control transmitted a new clearance to hold northeast of the VORTAC on the 035 radial, 10 DME fix, right turns. The pilots misinterpreted the clearance and entered holding at the 215/10 fix (035 bearing).

The Approach Control is a non-radar facility, so the error was not noticed until two civilian aircraft holding at the outer marker asked Approach Control why the C-130 was in their airspace. After Approach Control asked them to verify their position the pilots of the C-130 realized the error and proceeded to the correct holding fix.

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OPS TOPICS

KEEP THOSE EYEBALLS MOVING

A T-39 under radar control departed home AFB with an unrestricted climb clearance. As the aircraft broke out of a cloud deck the crew spotted a light plane right in their path. Evasive action prevented a collision with the aircraft passing within 100 feet of each other. No advisories had been issued. Remember

- Provision of VFR traffic advisories depends on controller workload.
- Even if the service is provided, it's subject to radar interpretation and equipment limitations, i.e., you may not get all conflicting traffic. (See "Radar Myths . . . Conceptions," *Aerospace Safety*, April 1977).
- It doesn't hurt to ask the guy on the ground for the service, either.
- Still on top of the "hit" parade is the ever-rotating MK I eyeball. (For some ideas on outside reference flying, see "Heads Up," *Aerospace Safety*, May 1977)—Sqn Ldr Peter White, RAAF, Directorate of Aerospace Safety.

SECOND GROUP OF SPACE SHUTTLE ASTRONAUTS INTERVIEWED

On August 15th, 20 astronaut candidates reported to the Johnson Space Center. This is the second group of applicants competing for the approximately 40 positions of pilot or mission specialist for the Space Shuttle. The initial screening will be completed by November, and the reporting date will be in mid-1978. Ten of the 20 applicants are USAF pilots with current assignments ranging from tactical fighters to test pilot. Once selected for the program, the candidates will go through a two year training and evaluation period before final selection is made.

OF BIRDS AND BEES

Here are two reasons for visors and pitot covers:

While on a low level nav route an A-7 struck a large bird, which penetrated the windscreen and struck the pilot in the face. Fortunately, the pilot habitually flew with his oxygen mask on and the visor down. The bird shattered his visor and damaged the mask, but the pilot was unhurt.

During an intercept the pilot of an F-4 felt an unusual sensitivity to control inputs. Shortly after this, the aircraft experienced an overstress of 7 G's.

During the recovery from the overstress the aircraft became very sluggish and hard to control. The maintenance troubleshooting after landing discovered a honey bee carcass lodged in the top of the ram air bellows inlet tube. The aircraft had not been flown for an extended period prior to the mishap flight.—Courtesy Navy Weekly Summary.

HOT SPOT

Approximately 6 minutes after takeoff on a practice scramble the cabin temp control valve on an F-106 failed, and the cabin temp went full hot. The pilot was unable to correct the situation. Before he could land about 17 minutes later, the extreme heat was causing him to have difficulty concentrating on radio and aircraft procedures. Such failures have caused major accidents in the past. If you do experience a cabin temp failure, follow your Dash One procedures and land as soon as you can. ★



"The continued reduction and prevention of regression is largely the collective responsibility of unit flying safety officers. They, through the medium of safety meetings, briefings, articles, analyses, and recommendations, must periodically remind aircrews of the lessons learned in prior mishaps."[1]

With this quote in mind, I would like to address two potential killers resulting from complacency: distraction and channelization. My renewed interest in these subjects was caused by a narrow escape from a major aircraft accident—a gear-up landing. Although there were physiological problems that set the stage for this "almost," distraction resulting from complacency was the major contributor. Following is some food for thought for those who haven't considered these subjects for a while.

When I turned base, I called the standard gear check, glanced at the flap and gear indicators and started my base turn cross-check —runway and airspeed. Halfway through the final turn I made my second check of the gear and flap indicators and rechecked the airspeed. It was too high. In fact, I couldn't get the aircraft slowed. With the speed brakes out and accepting a hot flare, mobile screamed "go around, go around, go around." Why does mobile tell you to go around in the flare? I thought the same thing, but did anyway. I found my answer when I reached for the gear handle. It was up.

When was the last time that you looked at your watch and, when you put your arm down, wondered what time it was. Try it on a friend. The next time he (she) glances at his (her) watch, wait a second and then ask for the time. This idea directly relates to scanning instruments in the cockpit. It is also what I call complacency. You look at the dial, but you know before you look what it will indicate; or you're thinking about something else and fail to absorb the information presented by the dial, whether it is a watch, engine instrument or gear indicator. Following are some quotes from major aircraft accidents to emphasize this point:

- Case A

Cause—Operations factor, operator. The copilot failed to properly monitor the flight instruments.

Results—The aircraft continued in a nose-low, left banking turn and was destroyed upon water impact.

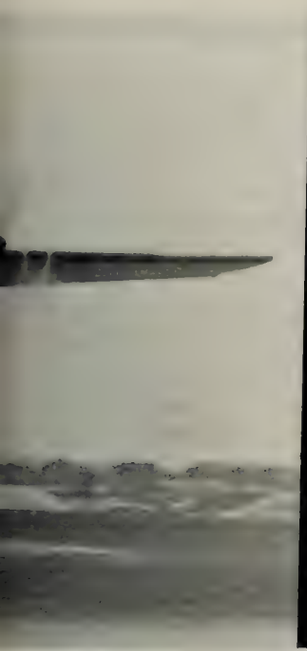
- Case B

Cause—Operations factor, operator. The pilot-in-training failed to adequately monitor aircraft airspeed.

Result — The aircraft touched down short of the overrun, shearing both main gear.

Aircraft accident reports are replete with this type of finding. In my case, complacency caused me to misinterpret the gear indicators. The resulting problem with airspeed control was so distracting that I failed to notice the warning horn or light in the handle.

1"Life Sciences," **USAF Safety Officers' Study Kit.**



Lesson Learned

For the past 15 years the Air Force has averaged more than four operator caused gear up accidents per year. This figure does not include the incidents where there was little or no damage or those cases where an alert moblie controller or tower operator prevented the mishap. So you can see that the problem is a continuing one, and this article addresses an important aspect of the problem.

1LT EDWIN WHITE, JR.
DC Air National Guard

To prevent this phenomenon, the pilot must make a conscious effort to absorb the information presented by a particular instrument or cue. Various techniques can be used such as repeating aloud to yourself what you see. Find a method that works for you and adopt it. By all means, remind yourself constantly why you are doing this.

Another common result of complacency is channelized attention which causes the pilot to concentrate on one task to the detriment of others. The following Navy definition of fascination is closely related to this concept:

"Fascination is a state of narrowed attention in which a pilot fails to respond adequately to a clearly defined stimulus situation in spite of the fact that all of the necessary cues are present for a proper response."[2]

Target fixation is one example of this. My concentration on controlling the high airspeed and resulting failure to respond to the warning horn is another. In many unexplained fatal range accidents, involvement of channelized attention is suspected. Two possible situations illustrate this point:

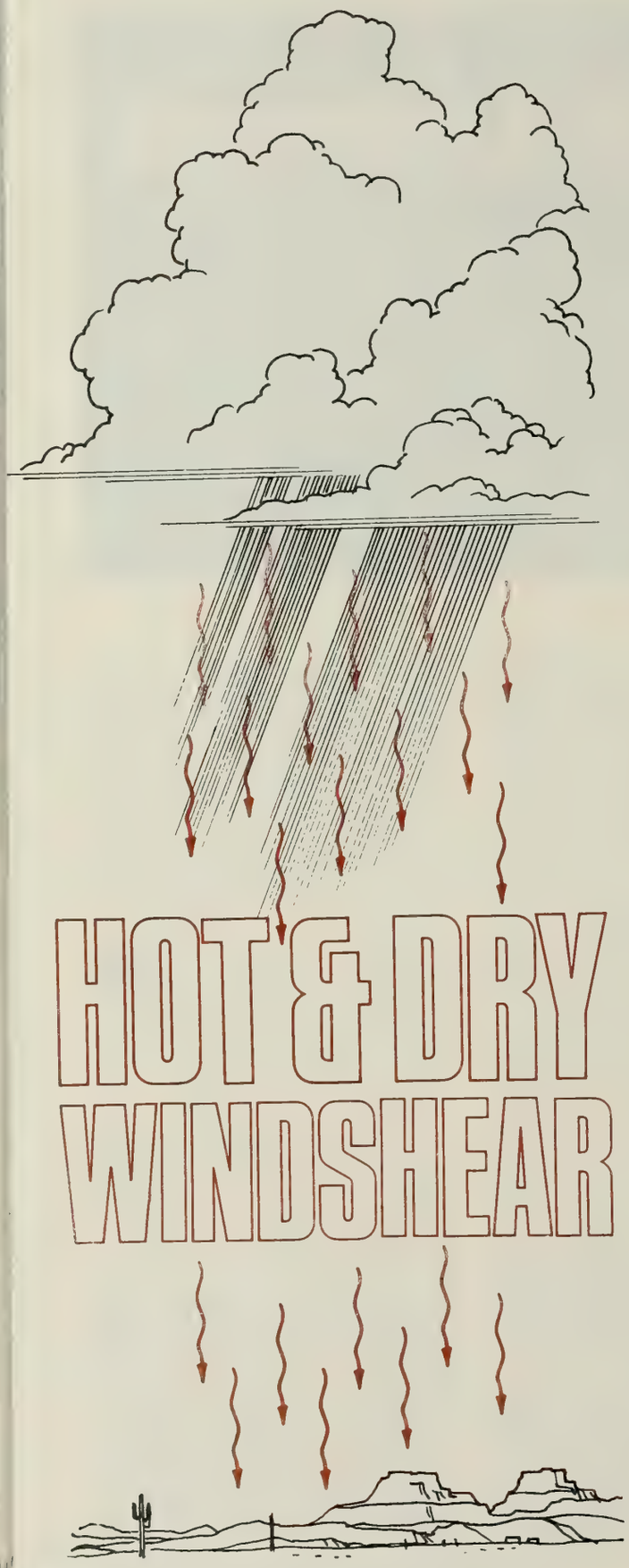
- The pilot fails to get a release on his first pass and concentrates on checking the armament switches. As he repositions for a reattack on the tactics target the aircraft impacts the ground.

- The pilot is intent on finding an unfamiliar target because he is worried about target acquisition. In the pop-up he picks up the target and fixates on it. He fails to recognize that he is inside the MAP and exceeding abort parameters because he does not check other cues such as horizon, apex altitude, dive angle and height above the terrain. He continues beyond the minimum recovery altitude and crashes.

Like hypoxia, these psychophysiologic problems are insidious. Unlike hypoxia, however, physiology plays a minor role in their cause. The pilot's attitude plays an important part in determining susceptibility. Anytime you lose situational or "total picture" awareness, you are probably experiencing distraction or channelization. Continually force yourself to look around, check another instrument, or ground reference. A mentally alert attitude is essential in minimizing the chances of distraction or channelization. If you feel something isn't right, abort the pass, go-around, or return to level flight. In Dash 1 terms, that's maintaining aircraft control. The next step is to analyze the situation. You may have to back up and reaccomplish checklist items. The time lost for another pass or approach is miniscule compared to the potential costs of an aircraft accident.

In conclusion, I spend more time interpreting the instruments now, and I look around more often. I've learned from my mistakes, and I'm hopeful you can learn from them also. If you're not continually cross-checking something while in flight you're probably suffering from complacency. ★

2 Vinacke, W. E., "'Fascination' in Flight," U.S. Naval School of Aviation Medicine Research Report No. NM 001 059.01.13 (X-148-AV-4-3). (July 8) 1946.



HOT & DRY WINDSHEAR

Windshear associated with strong thunderstorm winds has received much attention in the past year or so. This article looks at a different type shear condition all pilots should understand. We wish to thank United Airlines Meteorology Department for permission to print it here.—ed.

High based innocuous appearing cumulus clouds can be the root of severe downdraft and strong windshear. The dangerous phenomena occurs when rain falling from high based clouds chills the air causing a down flow. The extremely dry air into which the rain falls provides further refrigeration because of the evaporation of the water droplets. (The evaporation process is the heart of most refrigeration systems.) The combination of rain chilling and evaporation cools the downdraft well below the temperature of the surrounding air. It falls in a great cascade flowing down below the cloud until it is either dissipated by winds or by other mixing or until it reaches the ground to blow outward from the center of the downdraft. If the latter occurs, it will cause brief gusty surface winds. Light sprinkles or showers of rain may be reported if the evaporation process has not been completed before the rain reaches the ground. The rain and strong wind gusts virtually assure the presence of strong downdrafts and outflows. The effects of the downdraft and outflow as the aircraft passes through will be brief but they could be devastating.

Case histories indicate that this hazard may be expected under high based cumulus clouds whenever the following four conditions are met:

1. High based cumulus type clouds with VIRGA.

2. Very dry surface air with a dew point spread of 35°F* or more.

3. Weak winds from the ground to the cloud bases —generally less than 15 knots (any stronger winds would cause mixing and the down current would be destroyed).

4. Temperatures warmer than 75°F*.

*Temperature and dew point spreads are estimated on basis of limited samplings and are tentative.

Reports of gustiness in otherwise light surface winds and brief light showers confirm the existence of strong downdrafts and the accompanying outflow from these storms. It is prudent not to be lulled into

a false sense of security because of the apparently innocuous appearance of high based cumulus clouds.

CASE I

The flight was approaching Salt Lake City on a warm, late afternoon in August. There were clouds, generally high based, but nothing that appeared threatening. Some clouds had VIRGA (wisps or streaks of water or ice particles falling from the clouds but evaporating before reaching the ground) hanging from them, and light showers reached the surface here and there, but most rain evaporated before reaching the ground.

Reported weather was SLC 100 SCT E120 BKN 250 OVC 30 89/39/0809/997 RW SE ACCAS E-SW RE11 CIG RGD.

The captain noted some recent changes in wind direction and temperature at SLC while enroute and, because of recent windshear incidents and accidents, was primed to expect some kind of shear problem during approach.

The words of the flight crew describe what happened on their approach to land at SLC: "We crossed the Salt Lake City Omni 1,000 feet high at 6,300 feet vs 5,300 feet and were indicating between 140 and 150 knots. Approaching the Omni I felt a slight sinking and I started adding power. We hit a light ripple, then a rather abrupt moderate couple of bumps, almost immediately followed by the stick shaker. The airspeed had fallen somewhat below reference speed set at 114 and the rate of sink became 2,500 feet per minute down—or possibly more. We lost 700 feet very rapidly."

The captain reported there was no visual indication of shear and concluded by saying: "Please continue to promote any information available to determine these conditions and encourage awareness in everyone as to the extremely dangerous results of contact with shear of this type without preparation. It's frightening to survive what you know was very close to another fatal, mysterious crash short of the runway."

CASE II

On July 14, 1976 a 747 flight was approaching DEN during the evening hours. (Landing time was 0320Z.) Weather conditions were strikingly similar to those in the Salt Lake City incident. The hourly weather just prior to and after the event was:

DEN 0300Z 90 SCT 50 80/39/1807/004 TCU ALQDS VIRGA N 0400Z 120 BKN 20 80/31/1006/ CB E MOVG SE PK WND 0136/16 RB18 E31

Clouds were high based with VIRGA. Surface winds were generally light and south landings were in progress.

Early in the approach the wind shifted to a reported 3222 and the landing runway was changed from 17L to 26L. VIRGA was visible northwest of the airport. Descent was smooth but a preceding flight reported a moderate windshear at 150 feet. The wind was again given as 3222 (note there were 36 kt gusts from the north recorded at 0316Z, four minutes prior to touchdown but not transmitted to the crew). The captain increased airspeed in anticipation of the reported shear. At about 150 feet the airspeed built up sharply and at 100 ft moderate to severe turbulence was encountered. Sharp roll and yaw required rapid and aggressive inputs to maintain control and effect the landing.

Despite being forewarned by the preceding aircraft the crew was surprised by the intensity of the turbulence considering the apparent good weather and steady wind report on final.

Here is a comparison of the weather in each of these cases:

Weather Element	Case I	Case II	Remarks
1. Lowest cloud layer	100 SCT	90 SCT	High base
2. Visibility	30 mi	50 mi	No obstruction
3. Surface temperature	89° F	80° F	Hot to warm
4. Dew point spread	50° F	41° F	Very dry
5. Surface wind	0809	1807*	Light
6. Pertinent remarks	RW SE Altocumulus E-SW	Virga N Towering Cumulus	
7. Thunderstorms	None reported	None reported	

*Winds given for landing were 3222. Winds of 0136 were observed near the aproach time but were not transmitted to the flightcrew until they questioned the tower after landing.

It is apparent from the 0400Z report that a gust front crossed the airport, as indicated by the peak wind of 0136 at 0316Z. This gust front moved eastward to intercept the path of the descending aircraft. Rain showers followed shortly after. In spite of 13 minutes of rain the dew point spread of 49° at 0400Z was even greater than the previous hour. ★

"The Time Has Come The PILOT Said, "To Speak Of Many Things"



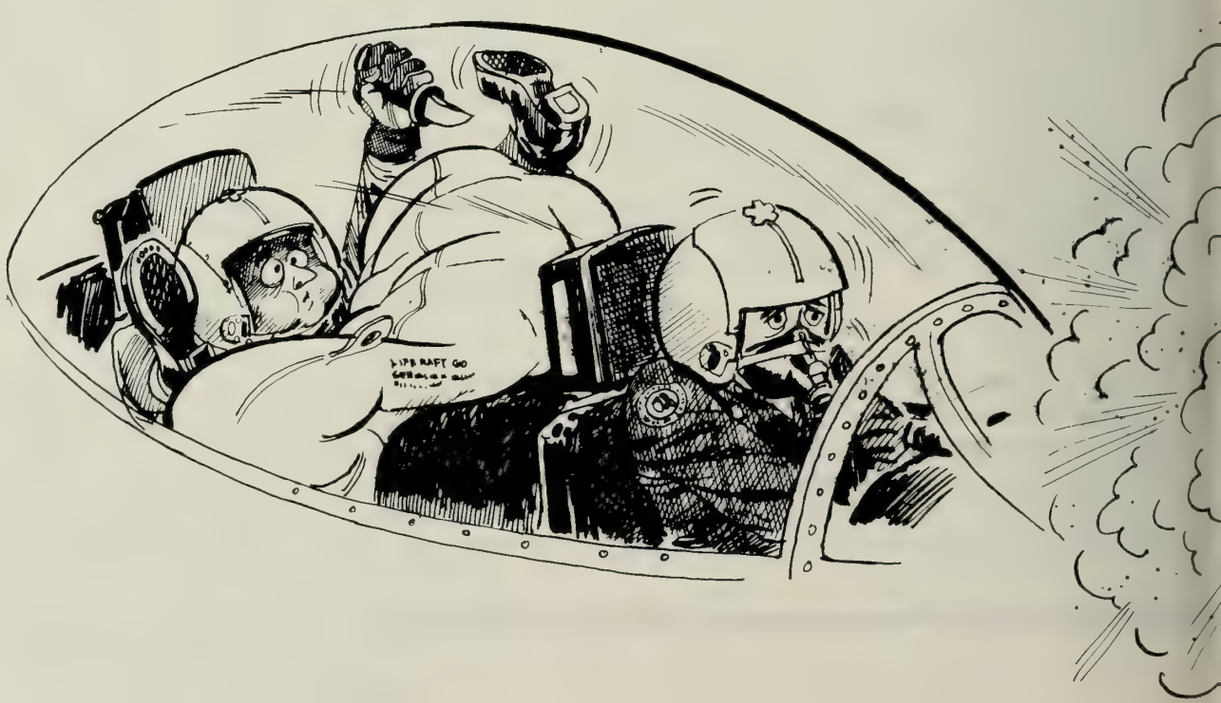
CAPTAIN
BRUCE E. SLASIENSKI
453 FTS
Mather AFB, CA

A T-33 was enroute between two European USAF bases. When the pilot in the rear seat attempted to change position, he inadvertently deployed the life raft in the survival kit. As the raft inflated it pushed the stick forward which caused the T-Bird to pitch over. The pilot in front attempted to correct the dive but met resistance when he pulled the stick back. Meanwhile, the GIB found and employed the raft deflation tool. Now things really got sticky. The front seater, trying to solve the control problem, heard an explosion and the cockpit filled with talcum powder which looked very much like smoke. The pilot identified the problem as engine failure, stopcocked the throttle, and secured the engine. As the haze cleared in the back, the GIB noticed the engine had flamed out and ejected. The front seater then dead sticked the T-Bird into a field.

The obvious factor in this accident was the lack of communication between the parties involved, but the underlying factors are more important in understanding why the events occurred at all. Without making any assumptions about the pre-flight condition of the pilots, we can investigate the human factors which interacted to cause damage to an airplane which was previously in pretty good shape.

One of the reasons flyers envy no other occupation is the way the earth spreads out below in a neat patchwork of greens, browns, yellows, and even sometimes the most brilliant whites. Add some of those puffy clouds that just beg you to pop through, and the radiant heat from the sun nicely offset by the air conditioning system, and you have what has got to be one of the best feelings in the world. Most articles on flight safety would probably go into a discussion of complacency now. That is not a relevant factor in this case; so, if it's complacency you want to learn about, go look elsewhere.

Maybe these two jocks were on the way home. "Get-home-itis" is a serious problem. I believe it killed the father of my best friend about 16 years ago. I don't believe it was a factor here. I don't think proficiency, weather, mechanical operations, air traffic control, health, or physiological factors were causes in this accident. The



primary factor in this accident was *attention*. Not lack of attention, but *attention* period. Each individual in that airplane was attending his own problems. He was in his own world.

We spend probably 80 percent of our time emphasizing what is known as the critical 11 minutes during takeoff and landing. So there we are, we made the takeoff and climb out, the pressure is off, the world is spread out at our feet, landing is a couple of hours off yet, so no sweat. Enjoy the view. Just content with being in the air in a dependable, comfortable airplane with all the problems left behind. The radio is quiet, the interphone is quiet, everyone is lost in his own thoughts. The three feet that separated those two people was about to become too great a distance to prevent the loss of the airplane.

The raft inflates in one world. He just took the action necessary to correct that situation. *Old George is sure going to laugh about this in the bar later on.* Wham! The raft deflates in a cloud of talcum, *what a mess in here, how dumb can you get. Something wrong! Too quiet—RPM winding down, EGT dropping, son-of-a-gun, lost the engine, airplane is diving—engine must have failed now the airplane is out of control —better get out now, so long T-Bird.*

Meanwhile up front.

Nice day out here—whoops, nose is going down, getting some resistance on the stick—nose still going down—everything else seems OK. RPM, E-Wham! . . . Smoke! . . . throttle off—maintain aircraft control—canopy just departed the aircraft—there goes the back seat. . . .

Two separate worlds. Plenty of attention, but the focus of the attention was directed toward handling the particular event occurring in each world. Ever feel like a flight of six on a B-52, or a flight of two in an F-4? The desire is to return to the feeling of contentment. Get rid of the problem with as little disturbance as possible. Direct professional action. The bold print doesn't tell anyone to talk—no one tells anyone to talk, at least not at first. "These steps are time critical and will save your life." True enough, but how about your crew? They have no more desire to depart the airplane than you do. But if they do make the decision to leave, it is probably because they are operating in an information vacuum. So (1) Maintain aircraft control (1a) Bring the rest of the crew back into your world (2) Analyze the situation (3) Perform the required actions (4) Talk to the crew as much as possible.

Communications is the key. That is just where we started from. Communications can bring help in solving the problem. In the T-33 situation, non-communications added another obstacle to the pilot which resulted in an accident. Communications is a human factor that can be dealt with on the ground. It should become habit, just like the rest of the emergency procedures. Insist that the flow of information goes both ways. Make communications a professional responsibility, not a social relationship. Anytime social status hinders professional communications, that marks a rank amateur and there is no room for an amateur in this business. ★





The Flight of the Enterprise

CAPTAIN
JAMES J. LAWRENCE
Directorate of Aerospace Safety

The Enterprise crew. On the left is Fred W. Haise, mission commander and veteran astronaut. He piloted the lunar module on Apollo 13. C. Gordon Fullerton is an Air Force lieutenant colonel and a former support crew member for Apollo 14 and 17 missions.

California Route 138 is a desolate stretch of highway that extends directly into the Mojave Desert. It's the type of road that you drive down and wonder if you'd ever be found again, should your car fail to continue operating. That was exactly what occupied my mind at 0-dark-30 on the morning of 12 August 1977. Why was I traversing this god-forsaken desert at 2:30 a.m. enroute from Norton AFB to Edwards AFB? What could be worth an 0100 get up?

We passed the Edwards AFB security gate and found we still had a long drive to reach any form of civilization. Finally, the sign for NASA, Dryden Flight Research Center appeared. As we reached the peak of a hill and started a slow descent into the press parking lot, it came into view. Against the inky backdrop of the early desert morning, the brilliant lights of the mating/device demanded our full attention. Now I fully realized why I was here.

The Space Shuttle Orbiter "Enterprise" sat atop the specially restructured Boeing 747. The magnitude of the technological accomplishments before me had not yet set in. The awe of the spectacle was all I could think about. I had stepped from the humdrum of old typewriters and 1969 Chevies into an adventure of **Star Trek.** That is when I first realized that, to quote a TV commercial, "The future is now." I knew immediately that I was to be witness to a new era of man's development. The door had creaked open just a little bit and I would be privileged to peek at what lies ahead of man in his conquest of the new frontier.

The excitement and events of that morning of 12 August 1977, I will presently describe for you. First I would like to briefly document the program development that resulted in the futuristic sight before my eyes. Of equal import is the mission and capabilities of this vehicle and the uses planned by NASA.

The story began back in August of 1972, when presidential and congressional approval was gained for development of the Space Shuttle Orbiter. This vehicle is only one part of the total Space Transportation System planned for the next decade. The rest includes the Space Lab, and the upper propulsion stages which have the capability to propel payloads into synchronous earth orbit and to other planets. The Shuttle will be used to place almost all of our future satellites in orbit and, more importantly, it will have the capability to retrieve malfunctioning satellites and repair them in orbit or return them to earth. No longer will it be necessary to write off a multi-million dollar satellite due to a malfunction following launch.

Structural assembly began in June 1974. The contractors selected for various major components were Rockwell International, General Dynamics, Grumman, and Fairchild. By March of 1976, these major components were developed and integrated. Complete final assembly was accomplished at Palmdale, California, and March 1976 to July 1977 was the system testing and crew training phase. An inconceivable amount of state-of-the-art technology and man-hours of labor went into the final product which stood before me.

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Brilliant against the desert night, the mating/demating device prepares to lower the Enterprise upon the specially restructured NASA Boeing 747.

Every development milestone was reached on schedule and costs were running well within the parameters anticipated.

Six captive flight tests began in May 1977. Here the jumbo 747, after several inert flight and wind tunnel tests, took off with the Space Shuttle Orbiter on top. Flight control tests, maneuverability, vibration analysis, and separation conditions were analyzed prior to the manned free flight phase. On August 12th all indications were go for the first of as many as eight Approach and Landing Tests (ALTs). This first shuttle free flight was designed to simulate the last two-and-a-half minutes of the Enterprise's space reentry profile. Obviously, the first flight of any aerospace vehicle is always the most important. Today would be no exception.

For those of you not familiar with the concept planned for the Space Shuttle in the near future, let me explain it. The Space Shuttle Orbiter is as big as a commercial DC-9 jetliner. Without payload or fuel, it weighs 150,000 pounds and is 122 feet in length with a wingspan of 78 feet. The Orbiter, plus two Solid Rocket Boosters (SRBs) and an external fuel tank make up the Space Shuttle system. When the first manned orbital flight occurs in early 1979, the sequence of events will follow a pattern similar to this. The Orbiter, attached to the back of the external fuel tank, with the solid boosters attached to each side,

The Jumbo Jet, commanded by NASA test pilot Fitzhugh L. Fulton, Jr., lifts off after a 6,000 foot takeoff roll.



The Enterprise and its mother ship, a Boeing 747 Jumbo Jet launch platform, make ready for separation 22,000 feet above the Mojave Desert.



Th explosive bolts are fired and astronauts Fred W. Haise and C. Gordon Fullerton begin their powerless descent glide.







Haise and Fullerton are met by their families following their successful flight at NASA, Dryden Flight Test Facility.



The Post-Mission Press Conference. Deke Slayton, ALT Program Manager, Fred Haise and Lt Col Fullerton answer questions for media representatives.

will take off from the Kennedy Space Center in Florida. The solid rocket boosters and Orbiter engines will fire in parallel at liftoff. These provide the thrust necessary for orbital insertion. The two SRBs are jettisoned after burnout and recovered by means of a parachute system. The large external fuel tank is jettisoned before the Shuttle goes into orbit. This fuel tank is the only nonretrievable component of the Space Shuttle System.

The orbital maneuvering system is used to attain the desired orbit and to make any subsequent maneuvers that may be required during the mission. The payload, in the form of satellites or experiments, is then injected into space by the Shuttle loadmaster. After orbital operations, deorbiting maneuvers are initiated. Reentry is made into the earth's atmosphere at a high angle of attack. At low altitude, the Orbiter goes into horizontal flight for an aircraft-type approach and landing at Kennedy. NASA expects a turnaround time of approximately 2 weeks between space shuttle flights.

When SRB separation occurs at approximately 27 miles up, the boosters descend via parachutes and land in the ocean approximately 150 nautical miles from the launch site. They are recovered by ships, returned to land, refurbished, and then reused. Useful life of each orbiter vehicle is estimated at 100 flights.

The shuttle system can place payloads of 65,000 pounds into orbit. Additional missions planned include retrieval of payloads for reuse, servicing or refurbishing of satellites in space, and operating and supplying of space laboratories in orbit. Of course, the biggest attraction of the Space Shuttle system is the reduction in operating costs. Boosters for the first time become reusable and the versatility of shuttle allows for repair of malfunctioning satellites. Of course, normal economic rules apply and as more launches are made, the cost of each will steadily decrease.

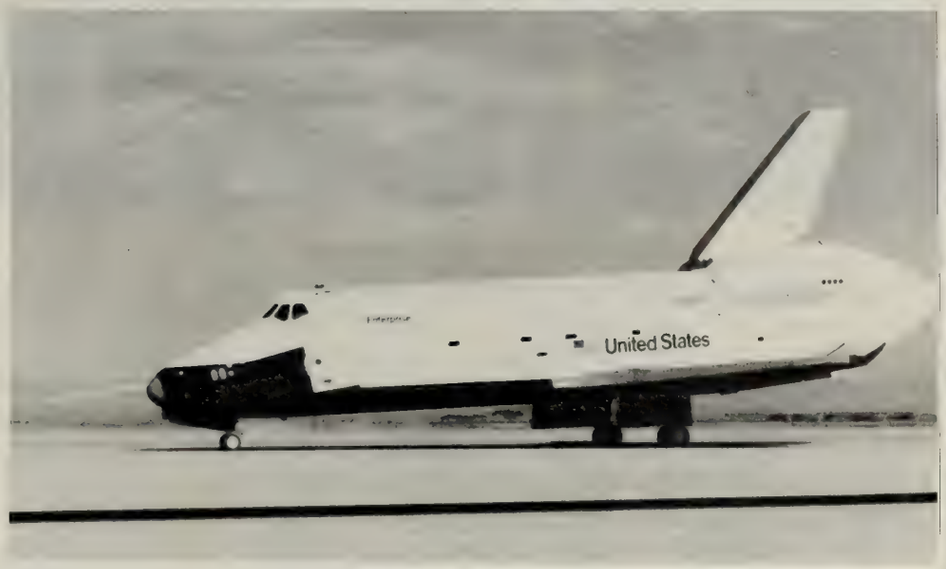
NASA is also heavily involved in a plan to cover shuttle operating costs over and above research and development expense. This plan concerns the charging of users for payloads carried into space. Projected customers, aside from NASA functions, include the Department of Defense with 23 percent of payload distribution, commercial requirements at 14 percent, foreign markets at 10 percent and 4 percent for other US Government agency needs. As confidence builds in space shuttle reliability, NASA feels they will gain more and more of the satellite market. Pricewise, they will be able to offer commercial and foreign clients a 40 percent reduction over the cost of an Atlas/Centaur launch.

With a description of the system and its capabilities behind us, let's return to the events of the morning of 12 August 1977. By launch time, it was apparent that

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This sequence of photographs traces the Flight of the Enterprise from initial flare to main gear touchdown. This first flare began 900 feet above the ground and as the airspeed decreased below 270 miles per hour, the landing gear was deployed. The aircraft's final flare cut the rate of descent to three feet per second. The crew held this descent rate until the gear touched down. The Flight of the Enterprise, from separation point to landing, logged just under six minutes of flying time.



The Space Shuttle Orbiter Enterprise safely lands following its maiden free fall flight. Nineteen miles of useable dry lake bed at Edwards AFB's Flight Test Facility served as its landing pad.

many others shared my opinion as to the significance of this mission. Over sixty thousand spectators jammed the access roads to Edwards AFB. Nearly 900 press representatives were accredited by the NASA Public Affairs Staff. Photographers and reporters swamped the press viewing site as the platform 747 taxied toward the runway, carrying its piggyback payload.

At precisely 8 a.m., the 747 started its 6,000 foot roll to takeoff. The liftoff was spectacular yet uneventful, as the 747 began a 200-foot per minute climb to 27,000 feet above ground level. It followed a precisely pre-planned track with the assistance of a ground controlled radar. Four NASA T-38 chase planes provided in-flight assistance as well as excellent airborne video tape of the flight's events. Forty minutes into the flight, the desired altitude, position, and airspeed were achieved.

The 747 platform ship began a nine-degree dive and increased its airspeed to over 300 miles per hour. Fitz Fulton, the 747 aircraft commander voiced the order, "Launch Ready." Almost immediately, shuttle commander Fred W. Haise and his copilot, C. Gordon Fullerton, fired the explosive bolts which separated the shuttle from its mother craft. The Enterprise began its long gliding descent to the dry lake bed landing strip in the desert below.

Three minutes from separation, after several controllability tests were successfully accomplished, the Enterprise began a turn to final. It rolled out 6,500 feet above the ground, nine miles out, with an airspeed of 310 miles per hour. The glide slope at this point was 9 degrees or three to four times that of a normal ILS descent. At 900 feet AGL, the Orbiter started its first flare, cutting the descent rate from 9 degrees to one and a half. As the airspeed decreased, the free fall landing gear were deployed at 200-300 feet above the ground. The final flare established a descent rate of 3 feet per second until touchdown occurred at approximately 185 knots. A 2-mile landing roll followed, exercising minimum brake usage.

The whole affair lasted slightly under 6 minutes. Three times I witnessed spontaneous applause from the press corps I accompanied; at separation, landing, and at the post mission press conference when the Enterprise crew entered the room. They, like me, sensed the significance of the occasion. Senator Barry Goldwater observed, "There are only two really important flights in the history of aviation. This and the first Wright Brother's flight." I have no way of gauging the relative impact this program will have, just as observers at Kitty Hawk had no way to measure the importance of what they witnessed. What I do know is that this first flight marks the beginning of a new era in man's exploration of that final frontier, and it was a real pleasure to be there to observe it. ★

USAF IFC APPROACH

A CONCEPT CALLED "60-TO-1"

Pilots attending the Instrument Pilot Instructor School feel that one of the most useful concepts they are exposed to is the "airspeed-versus-pitch relationship," commonly known as "the 60-to-1 Rule."

The 60-to-1 rule is actually a series of techniques for computing predictable aircraft performance. These techniques are important for three main reasons:

1. They allow the pilot to compute the pitch change (and the resulting vertical velocity) necessary when "Establishing an Attitude" during the control and performance procedures of Attitude Instrument Flying (Establish, Trim, and Crosscheck).

2. They reduce the pilot's workload (and increase his efficiency) by requiring fewer changes and less guesswork.

3. They provide an alternative to the "TLAR" (**T**hat **L**ooks **A**bout **R**ight) method of flying. An instructor pilot can teach this alternative, as opposed to trying to teach experience, as in the TLAR method.

The 60-to-1 Rule is based on two main constants:

1. 1° = 1 NM at 60 NM (hence the name, 60-to-1). You have heard this since pilot training but probably have had no idea how to apply it except for computing the distance between radials for course interceptions. Since 1 NM equals approximately 6000 ft, then the constant, 1° = 1 NM at 60 NM, can be rewritten as 1° = 6000' at 60 NM. This can be reduced to a more useable format:

1° = 100' at 1 NM . . . or, 1° = 100'/NM

This simply means that, regardless of airspeed, if you increase (or decrease) your pitch from a level flight attitude by 1°, you will climb (or descend) at a rate of 100'/NM. (Figure 1).

Fig 1

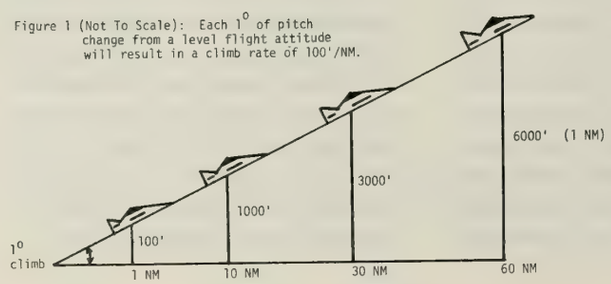


Figure 1 (Not To Scale): Each 1° of pitch change from a level flight attitude will result in a climb rate of 100'/NM.

2. True Airspeed (TAS), expressed in Nautical Miles per minute (NM/MIN), can be obtained from either TAS directly, or from the indicated Mach number:

a. Directly from TAS:

$$\frac{\text{TAS}}{60} = \text{NM/MIN}$$

EXAMPLE: $\frac{420 \text{ KTAS}}{60} = 7 \text{ NM/MIN}$

b. From Indicated Mach Number:

Mach number x 10 = NM/MIN

EXAMPLE: .7 Mach x 10 = 7 NM/MIN

From these two constants, other relationships may be determined. You may have heard that Mach number x 1000 will give you the vertical velocity (VV) in FT/MIN, for a 1° pitch change. What this oversimplified relationship really means is that if you can determine your NM/MIN, you can compute your vertical velocity. The formula for the required vertical velocity for any pitch change is:

VV for any pitch change = degrees of pitch change x NM/MIN x 100

EXAMPLES:

a. For a .6 Mach number and a 1° pitch change:

(1) NM/MIN = Mach number x 10
NM/MIN = .6 x 10 = 6 NM/MIN

(2) VV = degrees of pitch change x NM/MIN x 100
VV = 1 x 6 x 100 = 600 FT/MIN

b. For 420 KTAS and a 2° pitch change:

(1) $\text{NM/MIN} = \frac{\text{TAS}}{60}$

$\text{NM/MIN} = \frac{420}{60} = 7 \text{ NM/MIN}$

(2) VV = degrees of pitch change x NM/MIN x 100
VV = 2 x 7 x 100 = 1400 FT/MIN

Now let's look at some of the practical applications of these concepts:

1. Pitch Change Necessary for a Level Off (when climbing or descending). If VV = degrees pitch x NM/MIN x 100, then

$$\text{Pitch Change to Level Off} = \frac{\text{VV}}{\text{NM/MIN} \times 100}$$

EXAMPLE:

Climbing at 4200 FT/MIN at .7 Mach:

a. NM/MIN = Mach number x 10
NM/MIN = .7 x 10 = 7 NM/MIN

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By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

b. Pitch change to level off $= \frac{VV}{NM/MIN \times 100}$

Pitch change to level off $= \frac{4200}{7 \times 100} = 6°$

NOTE: An easy way to approximate this level of pitch change is to divide the Mach number into the VV (not taking into account the decimal point).

2. Descent Gradients (Enroute, Hi or Low altitude penetrations)

Required Pitch Change for Descent $= \frac{\text{Altitude to lose}}{\text{Distance to travel} \times 100}$

This can be simplified to:

$\frac{\text{Altitude to lose in "flight levels"}}{\text{Distance to Travel}}$

EXAMPLES:

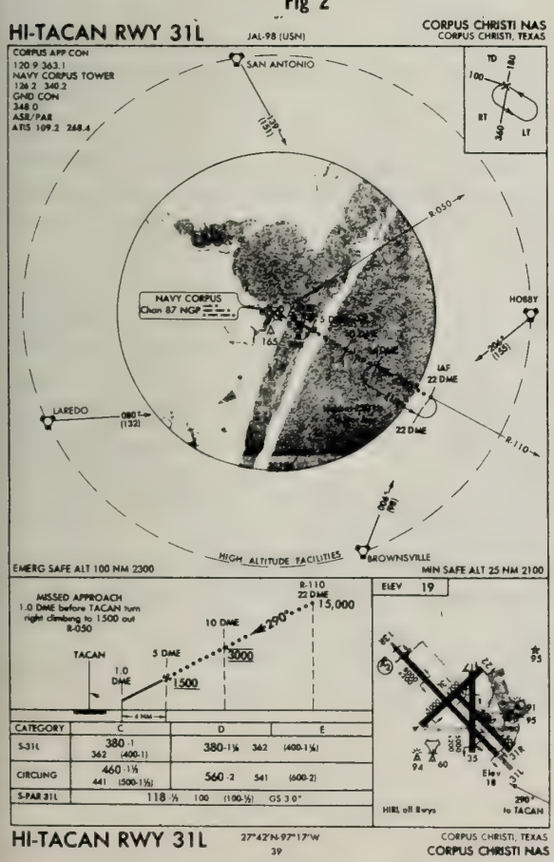
a. You want to lose 20,000 ft in 40 NM. What pitch change do you make?

Pitch Change $= \frac{\text{Altitude to lose in "flt levels"}}{\text{Distance to travel}}$

Pitch Change $= \frac{200}{40} = 5°$ pitch change to descend

b. A straight course penetration with an IAF at 22 DME and an IAF altitude of 15,000 ft, has a mandatory altitude of 3000 ft at 10 DME (see Figure 2). What pitch change is necessary to make the mandatory altitude?

Fig 2



$\text{Pitch Change} = \frac{\text{Altitude to lose}}{\text{Distance}}$

Pitch Change $= \frac{150 - 30}{22 - 10} = \frac{120}{12} = 10°$ pitch change to descend

Since the wind can throw off your computations as you proceed with the descent, an occasional recomputation of the required descent angle will tell you if you are progressing properly. NOTE: These computations should be made as easy as possible, that is, ROUND OFF numbers so that you can do the computations while flying. You can also check to see if you are holding the desired descent angle (in degrees) by using the "level off" formula from above:

$\text{Descent Angle} = \frac{VV}{NM/MIN \times 100}$

EXAMPLE: You are descending at .6 Mach number and your desired descent angle is 5°. You check the VVI and it is indicating 2400 FT/MIN. To crosscheck to see if you are holding the desired 5°, what formulas do you use?

NM/MIN = Mach number x 10 = .6 x 10 = 6 NM/MIN

$\text{Descent Angle} = \frac{VV}{NM/MIN \times 100} = \frac{2400}{6 \times 100} = 4°$ descent

So, your actual descent is 4°, but your desired descent is 5°. You will have to make an additional pitch change on the attitude indicator of 1°. How much will that 1° additional pitch change increase your VV? 600 FT/MIN. . . . Remember, 1° VV = NM/MIN x 100. So the total VV should read 2400 FT/MIN + 600 FT/MIN = 3000 FT/MIN, after making the 1° pitch correction. NOTE: You cannot, however, maintain this VV during a constant IAS descent because as the TAS (NM/MIN) decreases, the vertical velocity will decrease. Maintaining the pitch attitude on the attitude indicator and crosschecking the pitch angle by dividing the NM/MIN into the VV will help maintain your desired pitch angle and correct for any precession.

Another way to check your descent angle and to see if you are going to make your desired altitude at the desired distance (if you are flying directly to or from a TACAN or VORTAC) is to watch your al-

IFC continued

timeter movement in 1 NM of DME movement. This gives you the descent rate in "FT/NM," which can be converted to degrees, because 1° of pitch (regardless of speed) will equal 100' for every NM. Therefore, if you check your altimeter and it moves 500' in 1 NM, your descent angle is 5°. To check to see if you will make an altitude restriction, multiply this FT/NM by the miles to go.

EXAMPLE: You check your descent and it is 500 FT/NM. If you have 10 NM to go to your altitude restriction and 4000' to lose, check to see how much altitude you will lose by multiplying the FT/NM by the miles to go:

Altitude lost=FT/NM x NM=500 x 10=5000'
Therefore, if the 5° descent is maintained, you will reach the altitude restriction prior to the DME restriction.

3. Precision Glidepath (PAR or ILS)

a. The glidepath angle published for an approach (i.e., 3°, 2½°, etc.) will be the same for every aircraft. Therefore, a pitch change approximately equal to the published glidepath can be made on the attitude indicator when intercepting the glidepath.

b. Remember, True Airspeed has no effect upon the pitch change when intercepting the glidepath. Speed only affects the time on final and your rate of descent (VV).

c. Prior to glidepath interception, you should compute what your vertical velocity (VV) will be for your groundspeed (since you are flying off of a ground based glidepath transmitter), crosscheck that VV after making the initial pitch change after glidepath interception, and correct as necessary. The required VV can be computed in a number of ways:

(1) One way to determine the required VV is to refer to the "Rate of Descent Table" in the front of the FLIP Terminal Instrument Approach Procedure Books.

(2) Another way, is to use the basic VV formula mentioned earlier:

$$VV = \text{degrees of pitch} \times NM/MIN \times 100$$

EXAMPLE: T-39 on a 3° glidepath at 120 KTAS

$$NM/MIN = \frac{TAS}{60} = \frac{120}{60} = 2 \text{ NM/MIN}$$

$$VV = \text{degrees} \times NM/MIN \times 100 =$$
$$3 \times 2 \times 100 = 600 \text{ FT/MIN}$$

(3) A third way to approximate the VV for a 3° and a 2½° glidepath is by using the formulas:

$$VV \text{ for } 3° \text{ glidepath} = \frac{\text{Groundspeed} \times 10}{2}$$

For the VV for a 2½° glidepath, subtract 100 FT/MIN from the 3° glidepath formula.

EXAMPLES: T-38 with a groundspeed of 180 kts is flying a 3° glidepath.

$$VV \text{ for } 3° = \frac{\text{Groundspeed} \times 10}{2} =$$
$$\frac{180 \times 10}{2} = \frac{1800}{2} = 900 \text{ FT/MIN}$$

$$VV \text{ for } 2½° = 3° \text{ VV} - 100 =$$
$$900 - 100 = 800 \text{ FT/MIN}$$

You have just been given two weeks of training in five minutes, so if you are a little overwhelmed, it's natural. These relationships will become easier to work with after a little practice. It's best to start out practicing them in a "non-hurried" environment, such as during pre-flight planning or perhaps in your simulator. Although it may seem like an increase in workload at first, proficiency in the "60-to-1 Rule" techniques will save you time, help you become a smoother and more efficient pilot, and give you some more tools with which you can instruct more effectively.

If you desire to see a further breakdown on the formulas and proofs, we have a limited number of copies of "The 60-to-1 Rule Discussion," an IPIS handout, available. A copy will be sent to you upon request. If additional copies are needed, they may be reproduced locally. Your request should be addressed to:

USAF Instrument Flight Center/FSD
Randolph AFB TX 78148

If you have any instrument related questions, feel free to call us at AUTOVON 487-4276/4884. ★

LIBRARY U.S. AIR FORCE AEROSPACE SAFETY



Annually the Air Force recognizes a given number of individuals, units and commands for outstanding performance in safety. However, competition is keen and not all win major awards. To recognize all of those, AEROSPACE SAFETY is featuring one or more in each edition. In this way we can all share in recognizing their fine performance and, perhaps, learn some valuable lessons.

NOMINATED FOR THE CHIEF OF STAFF INDIVIDUAL SAFETY AWARD

Major James D. Ferry
14 FTW, Columbus AFB, MS

Major Ferry was nominated for this award for his outstanding contributions to improve safety within the organizational maintenance function.

His personal involvement and imaginative approach to safety made his use of the command developed safety program truly exemplary. Recognizing the need for credibility in the weekly safety briefings, Major Ferry involved the young, newly assigned airmen in preparation and presentation of the safety briefings. In this way the younger members of the squadron became knowledgeable and articulate on safety matters, increasing the influence of the safety program. As a further improvement, he went beyond merely using the material provided by the wing safety staff to developing and presenting items peculiar to the organizational maintenance squadron. This gave the members of the squadron a feeling that the program was truly theirs.

Recognizing that briefing guides rapidly become outdated, Major Ferry developed a method whereby the squadron Pre-departure Briefing Guide is frequently updated—to include data from recent mishaps.

One of Major Ferry's most popular and successful programs was a private automobile inspection. This inspection was performed by squadron mechanics using locally created checklists. The inspections were timed to coincide with the heavy Christmas leave and travel period. More than 200 vehicles were inspected and many serious defects were identified, especially badly worn tires. The accident prevention benefits to such a program are obvious.

Major Ferry's many contributions led to a significant reduction in squadron mishaps for 1976, reversing a previous adverse safety trend.

Mr. C. J. Moore
AFMTC, Lackland AFB, Texas

Mr. Moore was nominated for the Chief of Staff Individual Safety Award for his many contributions to safety as manager of the Air Force Military Training Center (AFMTC) explosives safety function. Following are some of his accomplishments: Forklift drivers working inside munitions bunkers were "passing out" when gasoline engines on the forklifts were operating. Mr. Moore found the problem to be poor ventilation and recommended corrective action that included operational changes, better supervision and, long range, replacement by electric forklifts to eliminate carbon monoxide.

Several M-16 rifles were found with split barrels. As a result of action by Mr. Moore, a series of M-16 barrels were condemned and replaced and improved life expectancy standards for the barrels have been implemented.

Mr. Moore established a Center Explosives Safety Committee, comprised of representatives from each organization which utilizes or stores explosives. Benefits include greatly improved rapport, cooperation, and ease of coordinating matters relating to all explosives safety operations for which the AFMTC safety function has responsibility.

Mr. Moore's contributions resulted in upgrading the AFMTC Explosives Safety Program to superior status. ★

ACE High

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety

Ask an aircraft commander what he feels is the most important factor in doing his job and he will probably tell you, "the ability to make timely in-flight decisions under stress." This quality has always marked successful aircraft commanders no matter how many engines or how large or small the crew.

But, the ability to perform well under stress is not natural to most of us. It is something we learn as we gain experience and get to know our tasks. While true of all fields this is particularly relevant to flying. Only through continued flight experience can a young pilot develop the decision-making skills which will fit him or her for a role as aircraft commander.

Such flight experience, to be effective, must involve the pilot in actual decision making. This must be coupled with a chance to practice and improve the basic flying skills originally learned in undergraduate pilot training.

Obviously, this is one function of training flights. The pilots and other crew members sharpen their skills in the particular mission for which they are trained. Yet this may not be the most effective way to develop such skills. A young pilot assigned to a tactical fighter has an advantage in developing his decision-making skills. Every time he flies, he is the aircraft commander. He must make all the decisions and perform all the functions required of the commander. Thus, his development of flying skills and abilities proceeds at a regular pace. Such an opportunity is not as readily available for the copilot on a multiplace aircraft. First his tasks are not the same. Since there is a designated aircraft commander, the copilot is not the primary decision maker on the crew. Granted the copilot will fly a portion of the mission, but the decisions are still those of the aircraft commander. The result is slower development of a copilot's decision-making ability.

This delayed development is particularly critical today because national economic factors and resource conservation have dictated a reduction in flying hours in certain mission aircraft. This means that copilots are less able to quickly develop the necessary skills to perform effectively as aircraft commanders—a situation which has serious implications for the future of the Air Force. The solution then would seem to be some way of providing flying opportunities at low cost for low experience pilots.

Such a program is in being. It is called the Accelerated Copilot Enrichment (ACE) Program, and it is a significant departure from the traditional Air Force approach to training.

ACE originated in the Low Cost



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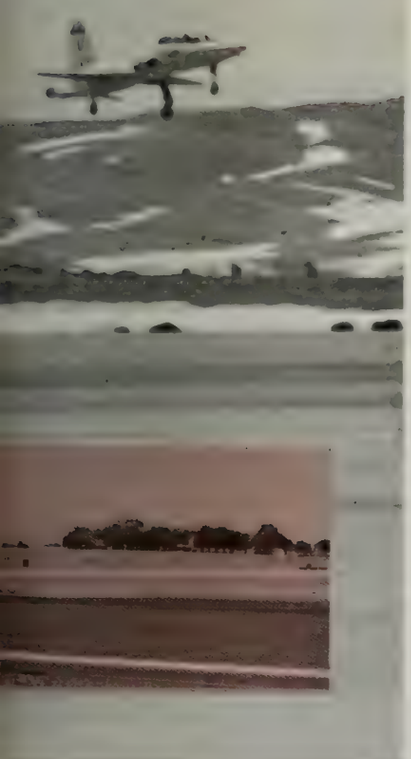
Aircraft Test Program initiated in the fall of 1975. This test consisted of Air Training Command aircraft and instructors working with SAC, TAC, and MAC aircrews. The program was conducted at four locations: Mather, Cannon, Eglin and Barksdale AFBs. The purpose of the test was to investigate the capability of a low cost aircraft to improve a pilot's basic flying skills and thereby enhance confidence, judgment and ability to make proper in-flight decisions even under stress. The test was terminated in May 1976 after proving that a low cost aircraft would be beneficial, in particular to SAC, in helping copilots prepare for the demanding role of aircraft commander.

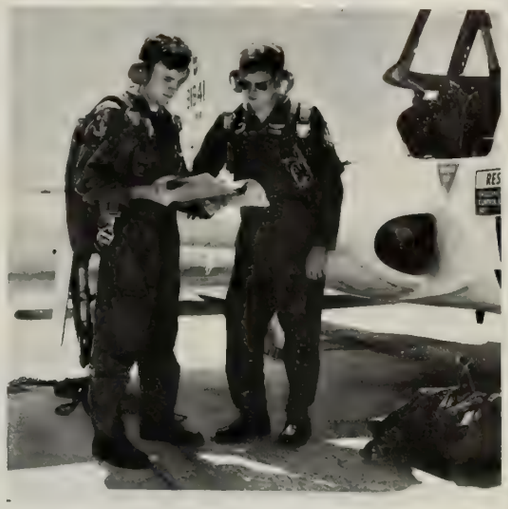
On June 1, 1976, the ACE Program came into being as a joint ATC/SAC effort. By the end of October 1976, there were operating locations at fifteen bases where SAC B-52/KC-135 organizations were located. By October 1977, all SAC CONUS units will be participating in the ACE Program.

How does the Program work? When a pilot in SAC is assigned to duty as a copilot on a numbered crew, in either the B-52 or KC-RC-EC-135, that pilot is entered into the ACE Program.

Since all the copilots have been previously qualified in the T-37 and T-38 aircraft, they need only a short checkout based on proficiency and crew availability. Once they are qualified, the goal of the program is for each copilot to fly five sorties per month. At least half

The ACE of today's Air Force is not necessarily a pilot with five enemy aircraft to his credit. A new program sponsored jointly by ATC and SAC is giving SAC copilots a chance to broaden their flying and decision-making skills in T-37 and T-38 aircraft. This program complements the SACM 51 series training each copilot receives in the assigned aircraft and improves the upgrade process to aircraft commander.





1Lt Steven Young, right, 323 FTW Flight Examiner and 1Lt Jerry Gontarek, 320 BW, 441 BS, looking over AFTO 781 Series Checklists.

1Lt Dan Schellinger, 28 AREFS copilot (right): "The ACE Program is great, fantastic. It should be continued. It gives you valuable experience in instrument flying as well as confidence and decision-making ability."



ACE High continued

of these sorties will be "team" (with another ACE copilot). All flight operations are conducted in a relatively unstructured environment. Since the purpose of the program is to provide SAC copilots greater opportunities to develop judgment, decision-making ability and self-confidence, direct supervision and "canned" profiles are kept to a minimum. ACE Pilots are responsible for all preparations for the flight, and cross-country trips are encouraged. Although there is a minimum of direct supervision, there are highly qualified instructors readily available to provide assistance when it is requested.

The program currently has over 650 SAC copilots enrolled. More than 600 are qualified in the aircraft at any one time. This is due



Instrument procedures practice in a high performance aircraft like the T-38 is a very good way for a young pilot to build his flying skills and judgment.



The competent instruction given by ATC IP's gives the SAC copilots the maximum benefit from every flying hour.

At SAC bases across the country new sounds are heard—the roar of a T-38 or the scream of a T-37, as ACE copilots build the skills to help them be better pilots and aircraft commanders.



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to the dynamic nature of the force. As a copilot upgrades to aircraft commander or is assigned to other duties outside the crew force, that person is replaced by another authorized copilot. Once the programmed expansion is completed in October of 1977 there will be over 1,000 SAC copilots participating.

ACE, despite its short life has had some real payoffs already. The young men in the program are learning valuable lessons in flying. While the worth of this experience will not truly show until they start to upgrade to aircraft commander, even as copilots their increased knowledge can only reap benefits. The cost of training is probably the biggest immediate payoff. It costs about $4,000 per hour to fly a B-52 and over $2,000 per hour for a KC-135. In contrast, a T-38 costs ⅛ as much as a B-52 to fly and a T-37 1/10 of the cost of a KC-135.

There is another benefit not originally considered in the program development. This is the experience afforded the ATC IPs who are assigned to the ACE Detachments. The detachment commander, for example, is receiving valuable experience in managing a "mini" squadron. The knowledge gained will benefit the Air Force later in providing men with wider experience in leadership and management. For the IPs, like the SAC pilots, the chance to fly in an unstructured environment, different from the home ATC base format gives these men the opportunity to grow in knowledge and experience.

The ACE Program is a dynamic approach to the old problem—*How do we get the most value for every hour of flight training?* The real advantages are long term and, in a sense, intangible. The only real measures will be the future performance of those pilots who once were ACE's. ★



FIRST USAF WOMEN PILOTS GRADUATE

On September 2,, 1977, the first class of women pilots graduated from UPT at Williams AFB AZ. This is the first of a test group of twenty women in two UPT classes. After graduation the new pilots will report to operational assignments in MAC, SAC, and ATC.

The graduates and their assignments are:

Capt Mary E. Donahue	KC-135	Seymour Johnson AFB NC
Capt Connie J. Engel	T-38	Williams AFB AZ
Capt Kathy La Sauce	C-141	Norton AFB CA
Capt Susan D. Rogers	C-9	Scott AFB IL
1st Lt Victoria K. Crawford	T-43	Mather AFB CA
1st Lt Mary M. Livingston	T-37	Columbus AFB MI
1st Lt Christine E. Schott	C-9	Scott AFB IL
1st Lt Sandra M. Scott	KC-135	Mather AFB CA
2nd Lt Carol A. Scherer	WC-130	Andersen AFB Guam
2nd Lt Kathleen Rambo	C-141	McGuire AFB NJ

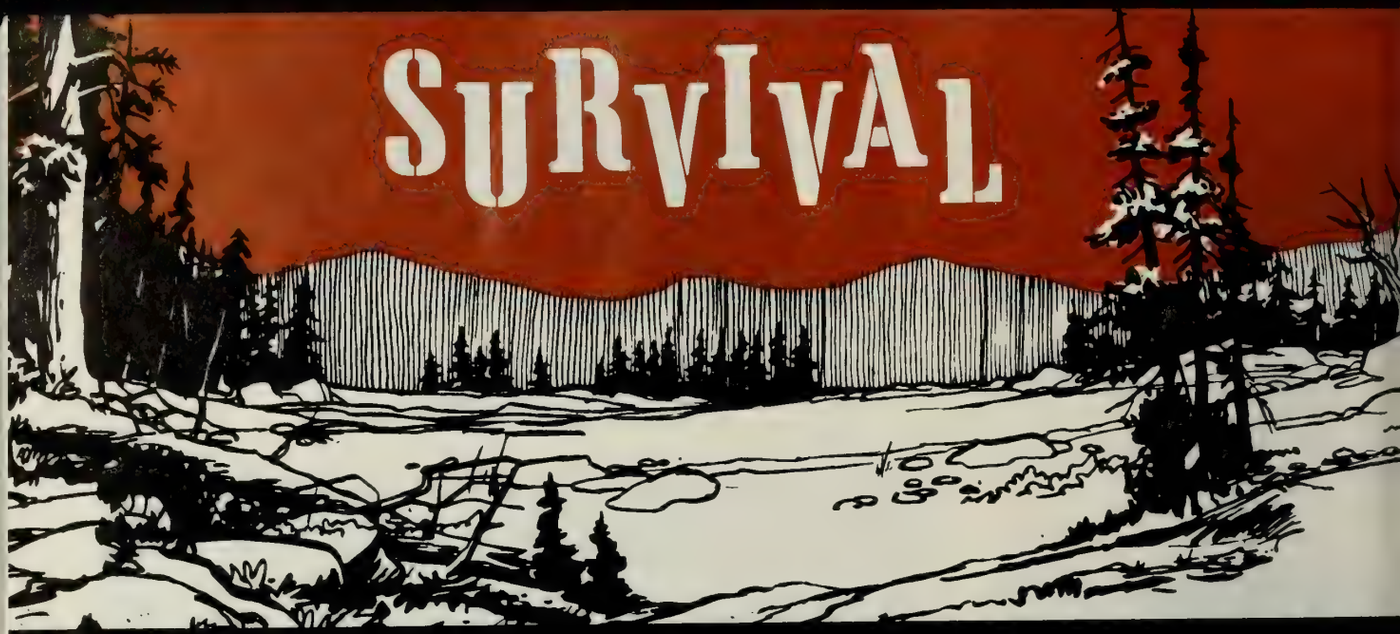
The second group of women pilots is scheduled to graduate in February 1978.

Name That Plane



This all metal follow-on to the P-26 eventually evolved into one of the most famous fighters of World War II. One export model of this aircraft gave US pilots quite a time since it was put into service with Swedish instrumentation and markings.





How to get lost without really trying

TSGT CHUCK ARNOLD
3636th Combat Crew Training Wing (ATC)
Operations and Requirements Branch
Fairchild AFB, WA

Jim was feeling queasy as he pulled himself up the rock ledge. His stomach was knotted and the impulse to vomit was almost overpowering.

It had been seven hours since he had come to the frightening conclusion that he was lost. He had initially felt quite confident that he could find his way back to his parked camper, but the early self-assurance was slowly ebbing as he crouched on the rocky slope attempting to gain a better view of the surrounding terrain.

The day had begun so beautifully. Jim and his family decided to take a drive into the mountains in search of some new areas to explore. He had parked the camper at the end of an old logging road where it intersected a mountain stream created by the melting snowpack.

The whole family ate lunch together and then went their separate ways in search of the new and unusual. Jim decided to follow an animal trial. It was well defined and had a number of fresh tracks that held the promise of some excitement if only he had a little luck.

It seemed but a short distance from where the camper was parked when a large deer bolted from a stand of buckbrush and bounded up the hill. Wanting to gain a better view of the animal with the hope of getting a good picture of it, Jim took off in pursuit.

The deer was a magnificent creature whose rack numbered at least six points by Western counting methods, and weighed approximately 350 pounds. Getting a picture of such an animal would be a feather in Jim's cap and it would provide ideal subject matter for the round table discussions at the next meeting of his amateur photography club.

The buck was a crafty critter who obviously had experienced pursuit in the past, for Jim never managed more than a glimpse of the animal in its headlong flight.

It had been approximately twelve thirty in the afternoon when Jim jumped the deer, and the first shadows of darkness were just creeping across the treetops when he decided to give up the chase. Not knowing how long he had been engaged in pursuing the buck, Jim became concerned as to his exact location. Not so much because he thought he was lost, but more from the standpoint of what was the shortest and quickest route back to the camper and his family. He knew his wife would be worried, and his excuse was pretty flimsy considering the amount of outdoor experience he had. To make matters worse, Jim was always lecturing the entire family not to travel too far from the camper and never to travel alone.

Having violated every rule he had ever preached only served to motivate Jim to pursue his impulses rather than his good sense. Acting accordingly, Jim began retracing his footsteps. The terrain was rocky and this effort soon fizzled. He

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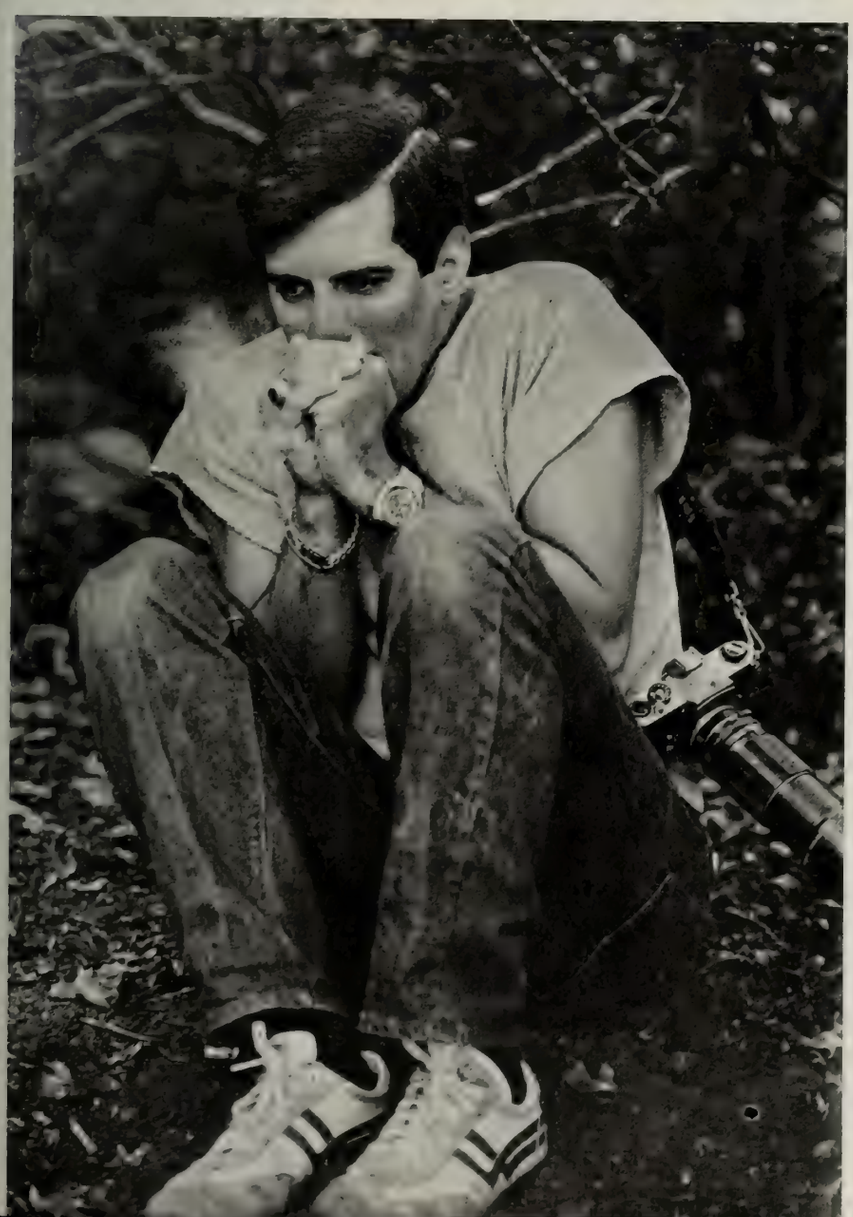
couldn't remember how many ridgelines he had crossed or even in which direction he had been traveling when chasing that elusive buck.

Exhaustion and frustration were becoming paramount in Jim's emotional makeup as darkness settled on the rolling hills and blotted out the last visible landmarks. Panic now gripped every muscle in his body and it took every bit of personal fortitude he could muster not to run helter skelter in search of his family.

Conditions now began to worsen. The temperature had plummeted to near freezing and a drizzle had begun to pelt the landscape—typical late spring weather. This served to alert Jim to the plight he was facing. He was dressed only in jeans, sweatshirt, and tennis shoes. He had no protection from the elements other than his own ingenuity. Jim was an experienced outdoorsman who had an abundance of knowledge and skill, but it was the unexpected swiftness with which he had become lost that now caused his thoughts to rush through his mind like an unending kaleidoscope.

As Jim huddled in the recesses of the trunk of a large fir tree to seek some respite from the biting cold, he wondered how he could have gotten into such a predicament. The cold was numbing and his thoughts were slowing until everything, even the steady drip of the falling rain, appeared to be held in suspended animation. . . .

Where did Jim go wrong? How did it come to pass that a person who is experienced in the out-of-doors becomes a victim of the environment he is supposed to understand so well?



The first mistake Jim made was taking off without informing his family about the direction he was going or even what his intentions were. Second, he failed to prepare himself for any eventuality by wearing, or at least taking along, enough protective clothing and equipment in the event of a sudden change in the weather. His third mistake was traveling alone, particularly when he was in unfamiliar terrain. "Never travel alone," is a vital factor to keep in mind, because so many unfortunate accidents can happen. An unexpected slip on a wet rock can result in a twisted or broken ankle rendering any unwary hiker vulnerable to his surroundings. The final ingredient was his disregard for noting prominent landmarks that could be used to guide his return route. Relying entirely on his own instincts and a false sense of confidence, Jim felt little need to waste time orienting himself to the terrain. Besides, he might lose any chance he had of getting a picture of the animal if he stopped. Any one of these factors could probably be overcome. But the trick is not to bet on the odds. Just don't take chances with your life.

The search party found Jim after a bleak, cold night of drizzle. He was still curled up in the trunk of that fir tree and his clothes were soaked clear through. The mistakes he had made were now coming to a final head as the search team carried him back to his original campsite on a stretcher.

Questions or comments on this article should be referred to 3636 CCTW/DOTO, Fairchild AFB WA 99011, or call AUTOVON 352-5470. ★

Mail & Miscellaneous

Send your ideas, comments, and questions to:
Editor, Aerospace Magazine
Norton, AFB, CA 92409

437TH MAW WINS FIRST SICOFFA AWARD

The 437th MAW is the first winner of a new prestigious flight safety award. This award (shown on the back cover) is presented by the System of Cooperation among American Air Forces (SICOFFA). The award is designed to recognize outstanding accomplishments in accident prevention by units in each air force of the Americas.

The criteria for the USAF award are similar to those for the Colombian Trophy. The difference is that eligibility for the SICOFAA Trophy will be limited to wings or groups operating in North and South America which have not had a Class A aircraft mishap over which they had control.

The 437th MAW's outstanding record makes the unit a fitting recipient of the first SICOFAA flight safety award.

SHORT SNORTERS

I would like to ask your help in publishing an article in the **Aerospace Safety** magazine.

As I understand it—during World War II and maybe at other times, dollar bills were signed by members of a crew and these were called short snorters. I have one of these dollar bills with several signatures and would like to publish this in hopes one of the individuals might read the article and contact me. I feel someone would really like to have this.

I have done my best in deciphering the signatures and they appear on the attached copy.

Not knowing much about this, I hope you may have someone in your agency that could furnish some information to put in an article with a copy of the bill.

If you can pass this on to other DOD agencies or suggest another method of publication I would appreciate it very much.

Thanking you in advance.

Mrs. Dorothy O'Brien
519 Humboldt St. #7
Reno, Nevada 89509

Mrs. O'Brien has sent us a copy of this bill, which is irreproducible, and the names which indicate that it was signed in 1943 at Prestwick, Scotland by the following:

1. *?*
2. *Norman Rowe*
3. *Francis Adams*
4. *Lt Fred J. ?uckert*
5. *Sgt George J. Goldman*
6. *Cpl John G. Taylor*
7. *Cpl Gilbert Schoenboth*
8. *Capt S. J. Coughman*
9. *Joe R. Brown*

—ed.

CONTROLLER WEATHER ADVISORIES

What may I as a pilot, expect in services from air traffic control personnel, in relation to weather? The question is addressed primarily to thunderstorm activity and areas of heavy precipitation. FAAH 7110.65, para 521 states: "Issue pertinent information on radar observed weather and chaff areas and suggest radar navigational assistance to avoid these areas. Provide this assistance only when the pilot requests it, whether or not you have previously suggested it. Do not use the word 'turbulence' in describing a condition in connection with weather echoes since radar scopes do not show areas of turbulence."

The above quote from the handbook may provide a sense of security. However there are other areas that must be addressed. What about the areas of precipitation that are not observed on radar? Yes, this is a possibility. Through the use of Circular Polarization and Moving Target Indicator there are areas of weather activity that are not observed by radar controllers. When using these features, particularly Circular Polarization, only the most severe buildup areas will be received. This consequently will result in precipitation being present without the controller knowing it. The major mission of both the controller and pilot is to have safe flight operations from takeoff until landing. With the combined efforts of both the pilot and controller this can be achieved. However, it is the responsibility of the pilot to initiate a request for vectors around areas of weather.

RICHARD M. GREEN, Captain, USAF
Chief, ATC Operations

"YOU AND THE D.A.," AEROSPACE SAFETY, JULY 1977

1. I read with interest the subject article. In general it is excellent, however, one additional factor influences the density altitude, the moisture content of the air. Significant differences in the density altitude can and do occur with different moisture contents.

2. Using the criteria in the article, pressure altitude, 500 ft, and outside air temperature, 30°C, the density altitude was recalculated using a CP-718/UM Density Altitude Computer. The recalculation, assuming the air to be dry, yielded a density altitude of 2320 ft ± 5 ft. If we assume the air to have moisture, which it normally does, the density altitude increases. If the dew point is 52°F, the density altitude would be 2500 ft; if the dew point is 85°F, the density altitude would be 2750 ft.

3. The calculations in para 2 are not intended to dispute the density altitude as derived from a flight computer (I obtained the same results using a CPU-26A/P computer). The purpose is to show that moisture also increases density altitude, or put another way, wet air is less dense than dry air. Thus, if a 2200 ft density altitude increases take off roll of many aircraft by approximately 20%, then the up to 500 ft increase in density altitude caused by moisture would also increase the take off roll. Putting all above in simple terms, if a pilot were operating in a desert, the density altitude from his flight computer may not be greatly in error, but if he were operating in the tropics, a factor should be added to compensate for the increased moisture in the air.

TERRY R. WARNER, Major, USAF
Commander, Det 10, 5 WS
Ft Benning, GA 31905

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ITED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



First Lieutenant

RONALD L. KUKURUDA

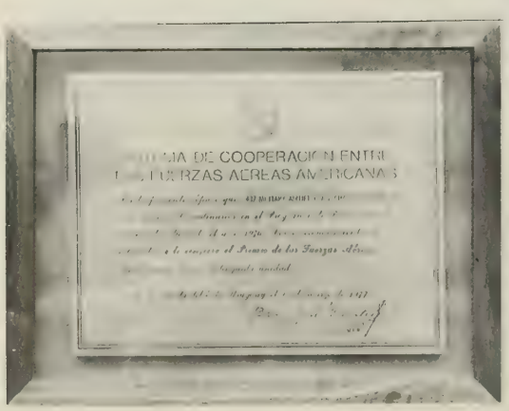
112th Tactical Fighter Group
Greater Pittsburgh International Airport
Pittsburgh, Pennsylvania

On 22 January 1977, the 112th Tactical Fighter Group was redeploying from Davis-Monthan AFB, Arizona. Runway conditions at Greater Pittsburgh International Airport necessitated recovering all the A-7D aircraft at Rickenbacker AFB, Ohio. Lieutenant Kukuruda was number three in a three ship flight. The flight was uneventful until, three miles out on initial at Rickenbacker (300 KIAS and 2500' MSL), Lieutenant Kukuruda's aircraft engine started to compressor stall. The engine hot light illuminated and TOT indicated 800°. He quickly retarded the throttle to lower the temperature; however, TOT increased rapidly at any attempt to advance throttle position. Lieutenant Kukuruda retarded the throttle again and selected manual fuel. Once again the TOT went out of limits when the throttle was advanced. He returned the throttle to idle and concentrated on making the runway. With airspeed and altitude decreasing, Lieutenant Kukuruda did one "S" turn, lowered the gear and flaps at approximately 240 KIAS, and landed halfway down the runway. He secured the engine just prior to engaging the departure end BAK-12. An initial investigation revealed a considerable number of turbine blades missing. Subsequent TDR findings determined a missing bolt in the airflow regulator caused improper inlet guide vane scheduling, resulting in a massive over-temperature condition. Lieutenant Kukuruda's correct analysis of this critical emergency under the pressure of minimum altitude and time, and his superior airmanship saved a valuable aircraft. WELL DONE! ★



New Inter-Americas Flight Safety Trophy Honors The 437th Military Airlift Wing

CHARLESTON AFB, SOUTH CAROLINA



The 437th Military Airlift Wing, first to receive new Flight Safety Award. Designed and presented jointly by the air forces of the Americas, the award is similar to the USAF Colombian Trophy.

PERMANENT PLAQUE AWARDED TO RECIPIENT (ENGLISH TRANSLATION)

SYSTEM OF COOPERATION AMONG THE AMERICAN AIR FORCES

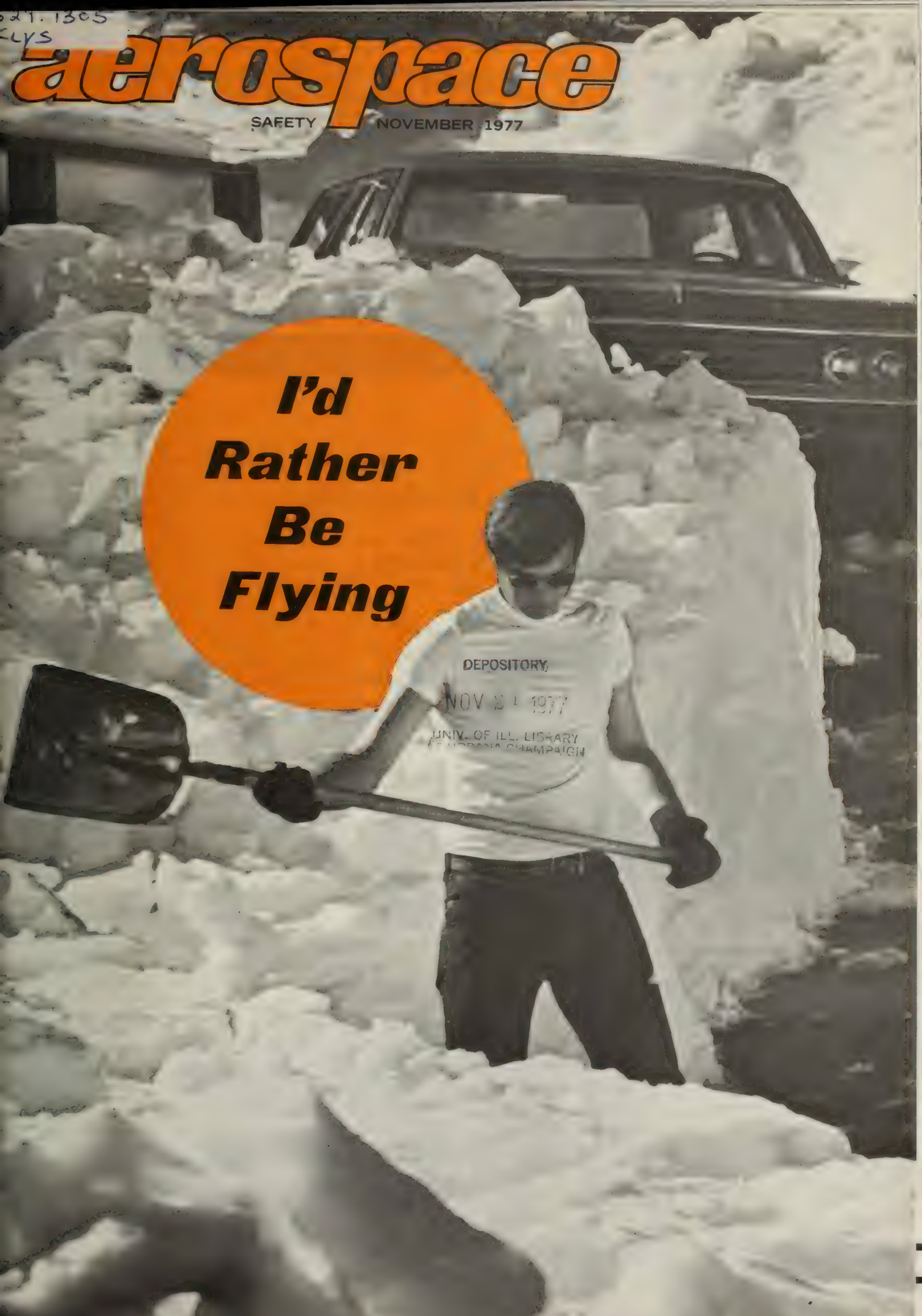
Be it known that the 437 Military Airlift Wing, Charleston AFB, S.C. achieved outstanding success in the Flight Safety Program during 1976. In recognition of this accomplishment, the system of cooperation among the American Air Forces' Flight Safety Award is presented to this distinguished unit.

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NOVEMBER 1977

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THE MISSION - - - - - - SAFELY!

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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NOVEMBER 1977 AFRP 127-2 VOLUME 33 NUMBER 11

NEWS FOR CREWS

Information and tips to help your career from the folks at Air Force Military Personnel Center, Randolph AFB, TX.

CAPTAIN DONALD E. MORSE
MAJOR MAX M. MAROSKO • Rated Officer Career Management Branch, AFMPC

PILOT MANNING OF NEW FIGHTER WEAPONS SYSTEMS

There are many factors which must be considered in manning our new fighter weapons systems. However, two distinct objectives stand out when establishing a sound personnel management plan. Foremost are: force stability and assignment equity.

Aircrew manning programs for new and future weapon systems must have as a goal maximum return on personnel costs invested. To attain this goal, the management plan calls for force stability which reduces PCS costs and builds expertise in the new system. By definition, force stability also reduces cross-training out of the system and in turn, training costs. To meet the objectives, personnel selection criteria are structured so that only proven performers with maximum retainability (regular or career reserve officers only) are chosen. As with most formal training, active duty service commitments associated with formal training guarantee short term retainability. Long term stability will be achieved by selecting individuals from across the experience scale (UPTS to OLD heads), thus providing for leadership and growth potential within the system.

Assignment equity requires drawing from the entire worldwide fighter resource. Under current rated management philosophy, all fighter aircraft must share in producing aircrews for a new system. If the source to man new systems were limited to a particular fighter aircraft, the training requirement and flow of pilots through that system would severely affect the combat potential of a segment of the force. This adverse impact on combat readiness is an unacceptable risk. At the same time cross-training into the new fighters from a non-fighter weapon system is not feasible. Fiscal constraints and the experience demands of all systems mitigate against cross flow, i.e., B-52 to F-15. As a result, new fighter pilot inputs are limited to UPT graduates, first assignments IPs (FAIPS) and other pilots who do not have any major weapon system identity, e.g., T-33, T-39, non-fighter qualified FAC, etc.

In summary, the overall goal in manning a new weapons system is to ensure the optimum return to the Air Force for its investment in training/personnel costs while concurrently maintaining overall mission readiness capability. These objectives can be achieved only by adhering to a manning plan which is based on force stability and equitable selection criteria. ★

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If you can picture yourself landing on a wet runway this winter, maybe you should keep in mind that...

Wet Runways Shrink



CAPT J. J. LAWRENCE
Directorate of
Aerospace Safety

Avoid standing water and brake with extreme caution. Watch out for the lower RCR's on painted surfaces and heavy rubber deposits.

GCA: "This is your final controller—How do you read me?"

PILOT: "Loud and clear."

GCA: "Roger, read you loud and clear, also. Special weather observation: 1522 zulu, sky condition 800 feet broken, visibility ¾ mile in rain showers. Runway is wet. Winds 250 degrees at 12 knots, weather service reports peak gusts to 20 knots."

PILOT: "Roger GCA, we copy."

"Okay," the pilot thinks to himself, "wet runway procedures. Firm touchdown. Five knots below normal approach speed. Land on the upwind side. Careful braking. Final approach speed is below main gear hydroplaning range. Watch the rubber deposits. I've done this many times before. SOP."

Three minutes later the crew accomplishes emergency ground egress procedures. As the pilot sits on the damp ground, waiting for help to arrive, he ponders why his aircraft came to a stop off the end of the runway, 6 inches deep in mud. Firm touchdown? Yes. On airspeed? Sure. Careful braking? He thought so. Landing zone? Where he normally puts it down.

First there was very little deceleration. Then the feeling of loss of control. The skid. Seeing the runway moving to the right on the windscreen, with inadequate response from the aerodynamic controls to keep it straight. Then it felt like he got some traction—and a loud bang sounded from the left side. Sharp veer—nose wheel steering engaged. Still sliding. The departure end of the runway growing larger in the windscreen. Off the end. The sudden stop in the mud. WHAT HAPPENED? He did everything by the book.

Unfortunately, the book does not tell the whole story. It cannot tell the whole story because this situation, heck, every situation is different. Let's go back and see some of the factors that attributed to this incident.

It started way back during the pilot's exterior inspection before the flight. When he checked the left wheel well area, he noticed that the main gear tire tread was worn down quite low. He even pointed this out to the resident crew chief but what he got in response was a verbatim tech order definition of when a tire must be changed. This tire was still within limits, although just barely. The weatherman indicated a possibility of rain showers at destination. Well, tech orders are tech orders, he didn't want to push the issue.

Next, the aircraft's speed. Five knots below the normal speed. Right, that's Dash One procedure. That computes to well below the dynamic hydroplaning speed listed. Fine and dandy. However, he should not have let this fact build his confidence. The computed speed may well have been below the dynamic hydroplaning speed range indicated in the tech order. This speed range, however, was based on the well known formula of speed equals 9 times the square root of

Slush is as hazardous as water. Severe hydroplaning on landing roll was followed by an uncontrolled departure from the landing surface and extensive aircraft damage.



the tire pressure, or $9\sqrt{PT}$. In pilot talk, that formula translated to a certain numerical speed. However, that speed is based on computations from a tire already in motion. If the tire is not already spinning, as is the case just prior to touchdown, the formula becomes $7\sqrt{PT}$. Add to this the condition of the tread on the left main gear tire and you have a hydroplaning airspeed which closely resembled the speed at which he was landing.

Continuing, let's examine his touchdown. First, the distance at which he touched down. Command regulations often require a certain threshold crossing height. Such rules are there because supervisors hate having to explain why aircraft consistently land in the overruns. The rules by themselves are all right; however, pilots, while complying with these rules, build a perspective which encourages glide paths that lead to touchdown a good distance down the runway. These habits and their associated visual references, may result in landings with a lot of runway (braking surface) wasted behind you.

Now, I am not proposing you break the rules. What I am saying is that the goal is to cross the threshold at the required altitude and still land as close to the end of the runway as possible, staying within the aircraft's descent rate limitations. This is what the pilot in this example should have concerned himself with.

The next aspect of the aircraft's touchdown is positioning on the runway. Usually the Dash One will tell you to pick the upwind side when landing in a crosswind. Most of the time, this is good advice. It gives you more room on the downwind side to counteract drift. This general rule is not always the best course of action on a wet runway.

In this case, the runway crown was in the center of the runway, therefore, water drain off was to both sides. The high crosswind kept the water standing on the upwind side. Touchdown was in the deepest area of standing water, thus, substantially increasing the probability of uncontrolled hydroplaning.

The answer is not in always landing in the center on a wet runway either; it is in determining the

A T-39 victim of hydroplaning. A wet runway and a crosswind resulted in a skid, a blown tire, and a departure from the runway surface.



Wet Runways Shrink continued

area with the least amount of standing water.

Do this as best you can visually or by checking with tower personnel and other aircraft that have made the approach before you. The condition of a worn main gear tire might also affect your decision on where to put the aircraft down.

All things considered, including a visual confirmation of the water drainage situation and the condition of the left tire, a landing on the crown of the runway would have offered the best course of action in this situation.

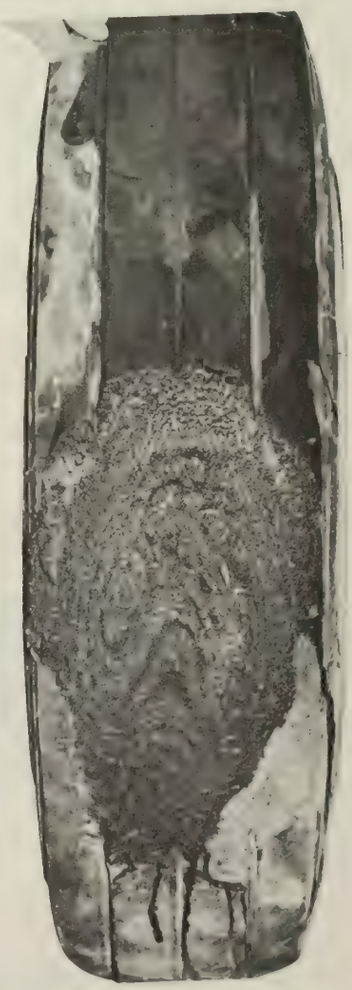
Another item that should have concerned the pilot during the special weather observation was that of the effect of first rain on a landing surface. Just like a highway, a runway has a great deal of oil, rubber particles, and grime on it. When a rain first begins to fall, these deposits mix with the water to create a very slick surface.

Although this initial slickness will eventually wash off, the remaining rubber deposits or painted surfaces, combined with a water film, will foster a second type of hydroplaning called *viscous*. This form is just as serious as dynamic hydroplaning in that braking friction and cornering capability are completely lost. It is more insidious than dynamic because it occurs at much lower speeds, even as low as 30 or 40 knots.

During landing roll, the last type of hydroplaning this pilot may have encountered is called *reverted rubber* hydroplaning. If you lock your brakes and the aircraft begins a skid, steam is generated between the runway and the tires. The heat from this steam causes the tire to actually melt and the molten state lubricates the area between the tire and the runway, resulting in loss of braking friction and aircraft control. This type of hydroplaning can occur down to zero knots of airspeed and will continue until you unlock the brakes and get the wheels rolling again.

Which type hydroplaning was the culprit for this embarrassed pilot? A, B, C, or all the above? The answer is not really relevant. One or all three could have occurred and the results could have been the same.

A classic example of reverted rubber hydroplaning. A locked wheel brake on a wet runway causes a skid and steam is generated between the tire and the runway surface. The tire rubber actually melts from the heat generated.



Loss of directional control, the skid, the blown tire, running off the runway end. It has happened with and without anti skid brakes. It has happened on long runways and on short runways. It happened yesterday and most likely it will happen again tomorrow.

What's a pilot to do? As the BMWIIC (Big Man What Is In Charge) of your aircraft, you can expect conditions which foster hydroplaning sometime in the near future. First of all, admit to a slight fear of wet runways. This is healthy, even for a fearless fighter pilot. Out of fear comes respect, and a wet runway is not a normal condition; therefore, it should be treated with respect.

Next, think about the situations which cause hydroplaning. Apply these situations to what you can expect in your aircraft. Go past that which the Dash One says can happen. Plan your response based on what may occur.

Have an acceptable deceleration rate for your aircraft in mind. For example, if by the _____ runway remaining marker, the speed is _____ or above, don't brake harder, initiate a go-around. If you have a copilot, let him call the runway remaining markers to key you to how well you are doing.

Mentally compute as much available information to determine your best course of action. Consider the runway characteristics, the effect of the crosswind, when it started raining, how heavily it has rained, gross weight, touchdown point, rubber deposits; the inputs go on and on. You cannot rely solely on the information available in the tech order. Judgment is the key word and the safe operation of that aerospace vehicle is both your goal and your responsibility. ★

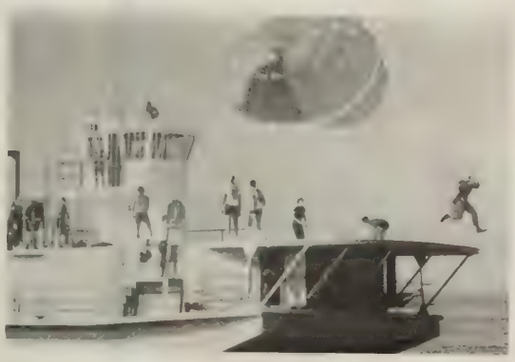
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GO JUMP IN BISCAYNE BAY

LT COL STANLEY J. BODNER
USAFRES, 3613 CCTS, Homestead AFB FL



Air Force Water Survival training includes instruction in proper drag position in case wind catches chute after landing.



Training includes two parasail "flights" to simulate actual descents and water landings. Students "walk-off" training vessel and are towed to approximately 500' altitude over Biscayne Bay prior to release.



Water Survival student receives instruction in mirror signaling.



Student at Homestead AFB inflates one-man life raft after surviving parasail descent into Biscayne Bay. He will spend approximately 1 hour afloat before partial helicopter lift-off and final recovery by boat.



Students are taught proper post-ejection procedures on descent from 45' training tower.

That's the word from hundreds of flyers who have had water survival training before experiencing an emergency over-water bailout.

They've learned first-hand that safety training pays. And the payout is priceless—their own lives.

These survivors are testimony to the effectiveness of that old Air Force flying safety adage (and Boy Scout motto), "Be Prepared."

Know your procedures. Know your equipment. Know what to expect.

And that's exactly what aircrews learn at the Air Force's only water survival school, conducted by the 3613 CCTS, at Homestead AFB, in Florida.

The course is an intensive, 3-day indoctrination in survival/life support principles, procedures, equipment and techniques. Its purpose is to train aircrews *before an emergency,* helping them survive an actual over-water bailout, ejection or ditching and assisting them in their safe recovery and return to duty.

It includes 3 days of classwork and field training in bailout procedures, raft familiarization and handling, signaling and communications, first aid, survival techniques and basic water and food procedures. In addition to the classroom instruction, students are given actual experience in parachute letdown via a cable descent from a 45-foot tower and a parasail ride (using a specially designed parachute) with an actual descent into Biscayne Bay. Other in-the-water training includes demonstrations on parachute drag, raft entry and housekeeping, signaling and helicopter pickup.

The course (S-V86-A, PDS Code V8D) is mandatory for all aircrews including the Air Force Reserve and Air National Guard. AFR 50-3 and AFM 50-5 provide information on policies, procedures, attendance requirement and course content. ★

"I'll just change the procedure this one time"...or...

YOU BET YOUR LIFE

MAJOR JOHN D. WOODRUFF
Directorate of Aerospace Safety



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KITTY HAWK 01

Orville and Wilbur Wright are sitting around their workshop preparing for their historical flight. Orville dozes off to sleep after a long discussion of procedures. He begins to dream as the first flight passes through his mind. A man with a megaphone screams over the noise of erratic engines readying for takeoff, "Kitty Hawk 01, cleared as filed, after departure turn right to 350, climb and maintain 2000, contact departure control on . . ." Orville suddenly awakens; "What was that all about?"

I'm sure the Wrights would be shocked at the volume of procedures used in aviation today. The procedures they planned for their first flight would appear ridiculously simple to us today, but for the intrepid brothers, they were complicated and extremely critical. However, the Wrights would probably be the first to tell you how critical procedures are for any type of operation. A few recent mishaps might point out the importance of procedures to increase your longevity.

YOU BET YOUR LIFE

An eight engine bomber flying transition at a base in the US was cleared for takeoff after a taxi back landing. The aircraft alignment appeared normal and takeoff roll was initiated.

Approximately 2500 feet from the end of the runway the aircraft veered abruptly to the right, left the runway with fire trailing, exploded and burned. What happened?

Approximately 2500 feet from the end of the runway the aircraft veered abruptly to the right, left the runway with fire trailing, exploded and burned. What happened?

Standard Dash One procedures were not followed in that the co-pilot failed to set, and the pilot failed to check, the fuel crossfeed valve switches open for takeoff. The combination of closed crossfeed valves, relatively low fuel tank levels, and rapid takeoff acceleration at light gross weights resulted in complete or partial power loss on two engines during takeoff roll. A simple procedure, violated, cost the crew's lives.

A tanker aircraft was scheduled to depart one base, refuel two flights of fighters and proceed to a second base for a night recovery. The enroute and air-refueling portions of the flight were completed routinely except for a reduction in the number of fighters and the planned fuel off load (thus, the tanker weight exceeded the normal by roughly 5000 pounds). Radio contact with GCA was established and the controller issued a frequency change to approach control's channel. The crew's acknowledgement was the last transmission received. A short time later, radar contact was lost and another pilot sighted a fireball off final.

The weather in the immediate area was worse than forecast at the flight plan weather briefing. How were procedures involved in this mishap? The aircraft commander failed to comply with checklist and procedures in numerous cases. He did not obtain the current weather prior to commencing the penetration; the planned overweight landing was not coordinated with the command post; the crew failed to reset altimeters to field barometric pressure at or prior to transition altitude; and the pilot descended below minimum approach segment altitude. Procedures tell the story again.

A fighter aircraft was the leader of a two-ship flight on an air refueling and RBS mission. After air refueling and enroute to the RBS, the wingman discovered that his outboard fuel tank would not feed. The wingman was to be given the lead of the flight in order to deal with his fuel problem. As the lead change was affected, the aircraft moving to the wing position pulled nose up with about 70 degrees of right bank, crossed over and then rolled in the opposite direction to settle into position. Witnesses described the maneuver as a "barrel roll" around the other aircraft. The aircraft went out of control and crashed. (Note: The aircraft was too low for safe ejection.) What procedures were violated in this mishap? Only a few, but they were fatal. The pilot deviated from his 55 series manual and the Dash One in the cross-over maneuver during lead change. Procedures cost the lives of two more crew members.

The crew's acknowledgement was the last transmission received. A short time later, radar contact was lost and another pilot sighted a fireball off final.

We see through these three examples that when procedures are violated, no matter what the reason, the results can be fatal. Do you ever bet your life by modifying procedures? Let's turn now to the reasons why we do things just one way.

WHY ONE WAY?

From a learning standpoint, it would be impossible to train people if we all did our own thing. Procedures give us a sequence of events to follow and psychologists say that sequencing is most important to the learning process. The human mind works best when things are ordered and structured. Our procedures provide that necessary degree of continuity for safe air operations. It would be impossible to fly formation, instruments, or tactical operations without some form of standardized procedures. Our tech order, 51, 55, and 60 series regulations, and instrument manuals all provide those desired elements of sequence and continuity.

Of course, safety is another reason why we have standardized procedures. If you have ever incorrectly executed a procedure, you've seen the element of safety dash into the picture. It happens suddenly and points out the necessity for having one way to do things. Obviously, safety in procedures emerges through controlled evaluation. Procedures are proven ways of doing things with our aircraft

YOU BET YOUR LIFE

continued

based on aircraft performance and human abilities.

Economics also enter every picture these days. Standardized procedures lead us to efficiency of operations. Thorough and efficient procedures practiced by all people streamline the work effort. They provide interface, continuity, and time savings.

So we are back to the obvious. We must have procedures for reasons of standardization, safety, and efficiency of operations. This leads us to our next question. Where do (what some of us have called ridiculous) procedures come from? Have you ever asked yourself, "Who thought up this asinine way of doing things?"

WHO DREAMED THIS UP?

It would be impractical in a subject of this magnitude to cover all the tech orders, manuals, and regulations, and define how they are prepared. However, an analysis of how tech orders are developed might increase our understanding of who has inputs to our procedures.

TO OO-5-1, Section III addresses review, validation and verification of tech orders (TOs). The purpose of the document is to ensure that TOs meet specified requirements. Air Force policy says that TOs must not be delivered unless quality assurance has been met in their preparation. Planning for TOs begins during the early "validation" and "full scale development" phases of a system and its associated equipment. The TO Management Agency (TOMA) ensures that TOs are being prepared in accordance with the contractual requirements and provides the Air Force an opportunity to provide additional detailed guidance. Although the TOMA is responsible for conducting in-process reviews, it is important to note that AFLC, ATC, and the using command participate to ensure reviews are complete and the requirements of using commands are considered in the reviews.

In validation, the contractor tests a TO for technical accuracy and it is evaluated by the blue suiters for adequacy of operation and maintenance. Verification consists of actual test by the using command of selected operating and maintenance procedures and associated checklist. The using command is an integral part of the review, validation, and verification process. Users assist the TOMA to ensure that the arrangement of material, method of presentation, and style and level of writing are commensurate with the established maintenance concept, and skills and training of personnel who will operate and maintain the equipment. Review team members have the experience to make objective and logical decisions based on all factors. More importantly, they are aware of USAF and major command policies.

So, as we can see, a lot of people are involved in the review, validation, and verification of tech orders. No one just dreamed them up. So if this much effort went into their planning, why do we violate them?

WHY DO WE VIOLATE THEM?

When we take it upon ourselves to modify established procedures,

When we take it upon ourselves to modify established procedures, we are courting disaster.

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we are courting disaster. Why do we ignore proven methods? Why are we so convinced our way is better? Does doing it our way really save that much time or eliminate extra work?

Let's consider several reasons why we might violate procedures:

- Maybe we never learned them in the first place.
- Possibly, we have forgotten the procedure.
- Perhaps, we really think we can do it better.
- Sometimes, we have a basic resentment of authority (at a relatively unconscious level).
- In rare instances, we may just revolt against authority (on a conscious level).
- More commonly, the spur of the moment violation (i.e., let me show you how we did it in the war).

Training will help us in the first two instances. If we never learned the procedure, our training procedures need an indepth review for adequacy. If we forgot the procedures, then we need to identify the areas of deficiency and emphasize them in our recurring training and standardization/evaluation program.

On some occasions, we may think we can do it better. Maybe we just don't understand the background or the procedure. A little research on its history might just enlighten us to the fact that our way has already been evaluated and just wasn't quite that hot. Also, how do we handle a basic resentment of authority on an unconscious level? If resentment of authority is your hang up, maybe you need to go back to the basics of standards and discipline. Discipline is the key to safe and successful air operations, and without it you are betting your life and the lives of others each and every time you fly. An outward (conscious) revolt must be handled immediately through discipline and re-education. Lastly, the key to the "spur of the moment" violation is ingrained self-discipline. To paraphrase Gen Patton, discipline must be a habit so engrained that it is stronger than the excitement of battle, or the fear of death. If you're unsuccessful in these endeavors, then you really have a problem.

Discipline is the key to safe and successful air operations, and without it you are betting your life and the lives of others each and every time you fly.

HOW CAN WE CHANGE THEM?

Rather than alter the procedure on your own, get the procedure evaluated and changed through the proper channels before "you bet your life" that your way is better. Start by talking to the standardization/evaluation people or your unit suggestion monitor. They can help you initiate your suggestion through the proper channels. More importantly, they can help you prepare the paperwork. How many times have you had a good suggestion snuffed out because you just couldn't find the right avenue of approach and didn't know how or what forms to fill out? Here are a few of the ways you can have a voice in procedures.

- Try an AF Form 847 to review the tech order or ops directives.
- An AFTO Form 22 will initiate a revision to any maintenance tech order.
- If it's a regulation, like the 55 series, submit an AF Form 847 to the office of primary responsibility.
- A hazardous situation will receive immediate attention when reported through a Hazard Report, AF Form 457.
- If you feel that your suggestion has economic advantages, then try an AF Form 1000 through the Air Force Suggestion Program. You might just make a little money for your interest.

Safety in your job is based upon procedures that are current and complete. If you don't believe they're adequate, then use the established channels of communication to change them.

LET'S USE THEM!

We have seen numerous ways that you can play "you bet your life." We all agree that for reasons of standardization, safety, and efficiency there is just one way for all of us to do something. Also, we know that procedures aren't just dreamed up. Many qualified people have spent a lot of time reviewing, validating, and verifying the correct way to do things. We have educated ourselves on why we violate procedures in hopes that we will be more conscious of why we should do things the right way. Furthermore, if we are really convinced our way is better, we have discussed numerous ways to change the procedure through channels or have them evaluated. The bottom line is that procedures are necessary so . . . let's use them! GOOD AIRMEN DO IT PROCEDURALLY! ★



"Here he shall see no enemy

but winter and rough weather."

William Shakespeare

As You Like It

WINTER WEATHER

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety

Winter and rough weather are truly the enemies of pilots and aircrews. But they can be held at bay by those who follow sensible precautions.

PLANNING

Like so many things, a flight goes so much better if you are well prepared. Planning is especially important during the winter.

Winter weather can change rapidly. Large areas of low ceilings and marginal flying conditions make careful flight planning even more important than during the summer. Without prior planning, a diversion for weather can quickly turn into a low fuel emergency or even an accident.



PREFLIGHT

In winter, there are some special precautions one should take during preflight. Snow, ice and frost should be removed from control surfaces, wings and wind screens. Check static ports, AOA vanes or probes, and hydraulic actuators for accumulations of snow, slush or ice. Sometimes snow is blown into a warm engine, melts and later freezes in the compressor section. Inlet plugs can prevent this but if they are not used, check the rotation of the compressor. If deicing fluid is used, be sure that all control surfaces operate freely after deicing. Observe any TO restrictions on deicing operations. Also, check to be sure the tires are not frozen to the ground as a result of ice freezing around them.





TAXI

Be very cautious during power applications. Slick ramps and taxiways require small, careful power applications. Another factor in power application is the effect of jet blast. Icy runways and taxiways are often treated with sand to increase RCR. The exhaust from an operating engine can kick up this sand and cause damage to people and equipment.

When taxiing, be especially alert for snowplows and other vehicles. Additionally, heavy accumulations of snow usually obscure most of the taxiway markings and



lights. Running over a taxi light can cause severe tire damage. Snowplow operators engaged in snow removal activities often are not able to see you.

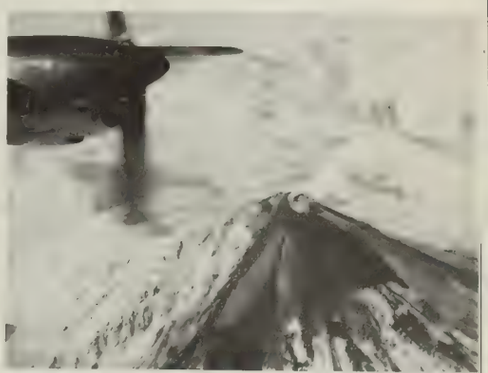
Taking corners on a slick taxiway can turn into a sporty proposition. Not only are nosewheel steering and braking less effective but, because of obscured markings, the pilot must be especially alert and anticipate clearances and route idiosyncrasies.

TAKEOFF

Most Dash 1's have restrictions on the amount of slush or snow



allowable for takeoff as well as minimum acceptable RCR's. Another common problem is the increased thrust available due to low temperatures. While the additional power is welcome from a takeoff roll point of view, sometimes this extra thrust makes it difficult to hold the brakes for a static engine check. Slush on the runway may also be thrown up into the gear wells. Once the aircraft is airborne, this slush can freeze and interfere with the operation of squat switches and gear cycles.



CRUISE

During winter everyone thinks of icing as a major problem. While icing is dangerous and has caused innumerable accidents, it is not as serious a problem for jets as for the lower flying recip aircraft. The jet's major wintertime problem is wind.

The jet stream is farther south in winter and most of the high altitude structure is covered by very strong winds. Not only do these winds make a major difference in fuel consumption, but they also

WINTER WEATHER continued

can cause severe turbulence. In mountainous areas, high winds create mountain wave activity.

A thorough briefing on winds aloft and on possible turbulence is mandatory.

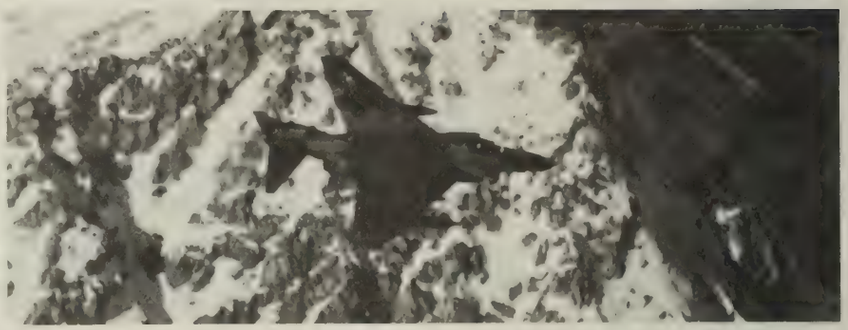
APPROACH AND LANDING

Low visibility is a very serious problem in winter aviation. The best defense in this case is a good offense. Now is the time to get your instrument proficiency up to speed. It will make your next 100 and ¼ approach a bit less hair-raising.

Of course, being on the ground does not mean that your troubles are over—hydroplaning and slippery runways are everywhere. The subject of hydroplaning is covered in an article beginning on page 2, but slippery runways are always an insidious danger. Runway condition reports are often vague or incomplete. Last winter an Air Force aircraft landed at a field with a fairly reasonable RCR for the touchdown zone. However, at the other end of the runway was sheet ice for 3,000 feet. The aircraft ran off the runway into a



snow bank. The best precaution against such an occurrence is foreknowledge. Try to learn as much as possible about conditions before you get there. A call to base ops can pay big dividends in knowledge of conditions, obstructions, etc. Ask for braking conditions reported by aircraft similar to your own.



SURVIVAL

One last thought—for those of us lucky enough to spend the winter in California, Arizona, or other places where summer-like flying prevails year round, winter is often something that happens to "the other guy." But what about that cross-country? Even if you stay south, you will cross some very high, very rugged, very cold terrain. The chance may be remote that you will have to abandon your aircraft over such terrain, but if you do, you need to be prepared. Also, if you have ever had to divert to Albuquerque when you planned to land at Tucson, you know how cold you can get with just a summer flight suit.

Knowledge and preparation are the keys to a safe, successful winter flying season. Every one of us involved in flying must make it our responsibility to be really ready for winter. ★

Name That Plane





World War II movie buffs should recognize this single-engine fighter. Picture John Wayne as flight lead in this three ship flight of "JUGGERNAUTS," nicknamed the "JUG." A highly versatile fighter, it piled up an impressive combat record during the war years. For answer see page 25.

THERE IS A WAY

Annually the Air Force recognizes a given number of individuals, units and commands for outstanding performance in safety. However, competition is keen and not all win major awards. To recognize all of those, AEROSPACE SAFETY is featuring one or more in each edition. In this way we can all share in recognizing their fine performance and, perhaps, learn some valuable lessons.

NOMINATED FOR THE
KOREN KOLLIGIAN, JR., TROPHY

Captain Jeffrey L. Moddle
401st Tactical Fighter Wing

During Captain Moddle's first ride as an IP in an F-4C, he had demonstrated a minimum-time turn and was about to ask his student to practice the maneuver. However, the nose of the aircraft continued to rise and the stick froze near the aft position. Check list actions failed to remedy the malfunction, and control was maintained with afterburner and rudder. Both pilots prepared for ejection. First, however, they made a last maximum joint effort to free the stick before ejecting. The stick broke partially loose and Captain Moddle was able to return to base and make a successful landing. Later, maintenance found an AIM-7 cable dust cover lodged in the stick bellcrank. Captain Moddle's handling of this emergency perhaps saved an aircraft and possibly one or more lives. He is a credit to the US Air Force.

NOMINATED FOR THE
COLOMBIAN TROPHY

Air Forces Iceland

During 1976 the Air Forces Iceland (AFI) received a number of awards attesting to its outstanding service as an Operational Combat Force responsible to the Commander, Iceland Defense Force. Among its achievements were Outstanding Unit Award, outstanding rating during Command Equipment Management Team Utilization Survey, 1st General Royal N. Baker Award for Logistics Excellence (Supply and Aircraft), 57 Fighter Interceptor Squadron selected winner of Hughes Trophy and USAF Flight Safety Certificate. The 57 FIS Munitions Branch performed more than 8300 missile maintenance and handling operations involving 135 tons of explosives without a single mishap. In ground safety there were no private or government motor vehicle accidents. These achievements indicate the outstanding performance of AFI.

NOMINATED FOR THE CHIEF OF STAFF INDIVIDUAL SAFETY AWARD

Major William R. Casey
432d Tactical Drone Group
Davis-Monthan AFB, Arizona

Despite the complexity of his squadron's equipment—DC-130 and CH-3 aircraft and five different models of remotely piloted vehicles—and the many different tasks associated with launch, remote control and aerial retrieval of the RPVs, there were no reportable mishaps in the 350 Strategic Reconnaissance Squadron (SAC) during the first six months of 1976. Then on 1 July, the squadron became the 22d Drone Squadron and was incorporated into the 432d Tactical Drone Group (TAC). Major Casey continued to act as the squadron safety chief. Only one minor boating mishap marred a perfect safety record, and Major Casey was assigned Chief of Safety for the 432d on 13 October. Under his leadership, mishaps were greatly reduced in all areas, and during the last two months of the year the Group had no reportable mishaps. ★

That Others May Live

A look at the Air Rescue Service and how they meet your needs today and plan for tomorrow



We are given a lot of information about new safety and survival equipment. We gain confidence in our equipment and ourselves through increased knowledge. In a survival situation, lack of knowledge and fear of the unknown can reduce our chances of recovery to zero. In combat, if you should find yourself on the ground after an unscheduled landing or a ride on the nylon elevator, you can take comfort in the knowledge that the people who will be coming to your aid are members of the Aerospace Rescue and Recovery Service (ARRS). The primary mission of ARRS is combat Search and Rescue (SAR). The people who carry out the combat rescue mission are experienced, well trained professionals. They are ready whenever you may need them.

To carry out the combat rescue mission, ARRS uses both fixed and rotary wing aircraft.

The HC-130 provides fixed wing support for combat rescue. Its primary functions involve: long range search and rescue capability, communications for command and control, pararescue deployment platform, and tanker support for helicopter refueling.

Of the more than 200 aircraft ARRS possesses, 140 are helicopters. At present, ARRS has three types of helicopters: The HH-53 Super Jolly Green Giant, the HH-3 Jolly Green Giant, and the UH-1.

The HH-53 is the largest, fastest, and most powerful helicopter in the Air Force. The HH-53 was developed to complement the HH-3E in combat aircrew rescue, and to perform the Apollo spacecraft and astronaut recovery mission. The HH-53 is capable of attaining a speed of 195 mph and cruises at 172 mph. Its service ceiling is 16,000 feet and it can lift more than 18,000 pounds. It features jettisonable auxiliary fuel tanks and can be refueled in flight. It is equipped with a rescue hoist and 240 feet of cable with a forest penetrator seat. The HH-53 has self-sealing fuel tanks, armor plating, and all-weather capability.

The second largest ARRS helicopter is the HH-3E. The HH-3E is a twin-turbine helicopter which served as the primary rescue helicopter in Southeast Asia (SEA) for five years and accounted for 567 lives saved. With a top speed of 162 mph, the HH-3E has armor plating, jettisonable fuel tanks and a rescue hoist with 240 feet of cable and a forest penetrator seat. Auxiliary fuel tanks on its sponsons enable it to carry a 2,400-pound load 600 miles.

The third type of ARRS helicopter is the UH-1. The H-1 is the replacement helicopter for the HH-43, long the ARRS helicopter mainstay. Three H-1 series aircraft are currently in the ARRS active and reserve inventories. They are the HH-1H, UH-1N, and UH-1F. The UH-1N and HH-1H are hoist and cargo equipped for the ARRS rescue mission. The UH-1F is used primarily for missile support and is not rescue configured. These three different types of helicopters give ARRS a wide variety of capabilities.

While the HC-130 may be used to locate your position and deploy pararescue personnel to assist you, if a recovery by aircraft is attempted, it will probably be accomplished by one of Rescue's helicopters.

During the past few years, ARRS has greatly improved its ability to use helicopters in accomplishing combat rescues. As you may recall, the basic concept developed in Southeast Asia for the recovery of downed airmen was a mission profile that involved the use of a high altitude and low altitude helicopter. The high and low helicopters were

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CAPTAIN EDWARD F. WITTEL
Aircrew Training Officer
HQ Aerospace Rescue and Recovery Service
Scott AFB, Illinois

escorted to the rescue area by A-1 or A-7 fighter escorts. The survivor would be located by the escort aircraft, the threat assessed, and the low helicopter committed to the recovery. During hoist recovery, the escort aircraft provided protective cover. The high helicopter would remain in reserve at a safe close-in orbit point. An HC-130 would provide command and control, plus serve as an air refueling platform for the helicopters. This concept of rescue and recovery was limited to day, visual flight rules conditions, thereby giving the enemy a distinct advantage. Towards the end of the conflict in Southeast Asia, a Night Recovery System (NRS) was developed for the HH-53 (*Aerospace Safety*, May 1977). This limited night helicopter rescue capability, when coupled with the AC-130 gunship, proved feasible in a low-threat environment.

We have learned that the SEA-era helicopter tactics may not be acceptable for use in a future high threat environment. We know, for example, that we must develop new helicopter tactics such as terrain masking, which is low altitude flying using the available terrain as camouflage, and improved night recovery procedures and equipment. To these ends, we have initiated concentrated efforts to develop new tactics and procedures to meet our future challenges.

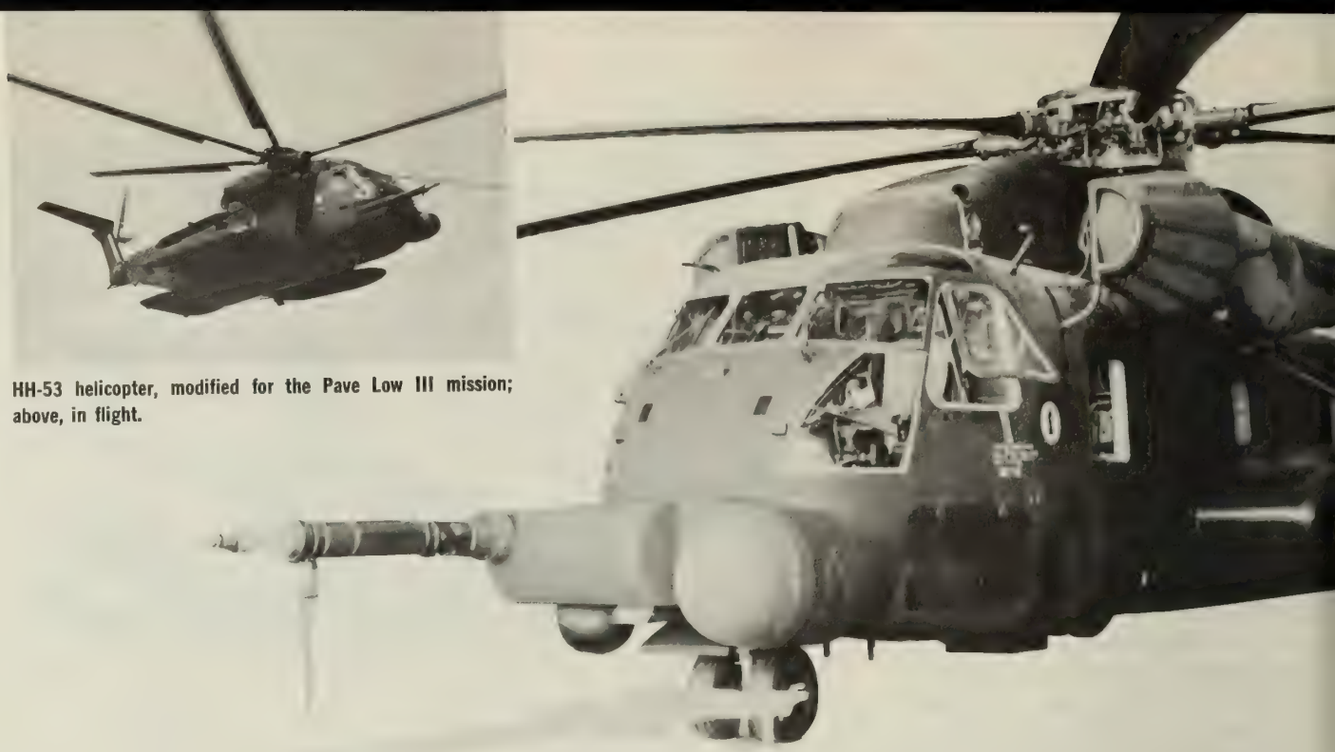
To meet future challenges and to be able to conduct operations in a high threat environment, our helicopter night recovery concept was further expanded in a desire to provide totally covert operations that would allow low altitude terrain masking penetration at night, in adverse weather, to avoid detection in an electronic warfare environment. The result of this development effort was the Pave Low III HH-53



HH-3C saw much war service in SEA. AARS people and aircraft perform heroic service in any climate, any terrain, day or night.







HH-53 helicopter, modified for the Pave Low III mission; above, in flight.

helicopter, which will feature terrain following and terrain avoidance radar, doppler-inertial navigation systems, projected map display, forward looking infrared electro-optical sensor, an electronic location finder, and hover coupler, all interfaced with a central avionics computer.

Although the time and place of future combat SAR efforts cannot be predicted, we can examine possible mission scenarios to better prepare ourselves for this role. Past experience has identified various problems that include deficiencies of avionics, personal survival equipment and operational equipment. Of prime concern has been the total time and effort spent in completing a rescue. We know that the probability of an aircrew member's survival decreases rapidly after approximately two hours. Successful missions in SEA required an average of nine sorties to complete the rescue.

To analyze that part of the SAR mission relative to pinpointing a survivor's location and to project future survival avionics requirements, a computer simulation model and a computer program known as Combat Rescue Mission Analysis (CRMA) were developed.

One important aspect of the CRMA program is that it will be able to take, as an input, a combat rescue scenario that includes variables such as: The length of the war, tactical aircraft sortie rates, attrition rates, and crew sizes, downed crew member location and survival times, rescue vehicle concept of operation, and maintenance data. For a specified time interval such as every twelve hours during the war, it will output the expected number of rescue vehicles available and assigned to missions, the expected number of downed crew members rescued and assigned to be rescued, and the expected number of sorties to be flown and rescue vehicles lost.

The CRMA Program may also be used as an aid in evaluating future force structure proposals, training requirements, and life support equipment. CRMA could be used to examine mixtures of types of rescue vehicles in the force, positioning of rescue forces, and deployment plans in an effort to obtain optimum rescue capability for the expenditure required. A study of training requirements and life support equipment would help ascertain their effect on success of the rescue mission.

The CRMA Program will not provide the solutions for all combat rescue problems but it will give us additional insight into the effectiveness of proposed solutions and will help us to identify areas which need to be examined more closely.

For improved individual survival equipment, research is being conducted to develop an improved SAR beacon which will have the capabilities to indicate both the downed crew member's position and authentication. Research and Development is also being conducted with recovery systems and equipment which will use satellites, advanced laser technology and improved infrared capabilities.

Programs such as these will allow us to more effectively accomplish our future missions in support of combat rescue.

As we resolve the problems that we predict will be facing us in the future, you can rest assured that if you need us, Rescue will be there, doing our best "That Others May Live." ★

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OPS TOPICS

ENGINES

Engine related incidents continue to be the single largest cause factor in Class A and Class B+ (over $50,000) mishaps. The percentage of these mishaps that are FOD related is very high. As aircrew members, you can help. First, be especially careful during preflights. Spend some extra time examining the engine intakes, and carefully check all panels for loose screws and Zeus fasteners. Secondly, avoid taxiing through or near areas with debris and stones. Third, stay away from the jet blast of other aircraft.

HELP

Support your local safety officer. Without you, his program is a big zero. The FSO has the tools and the influence to change things. Tell him about the mission or aircraft problems you encounter. Contribute your expertise during his safety meetings. Give him your ideas on how he can do his job more efficiently and effectively.

GROUND ACCIDENTS

• A B-52 sustained damage in the area of its external power receptacle when the crew misinterpreted maintenance personnel instructions. The pilot thought the aircraft was free of obstructions when the crew chief walked clear of the left wing. He observed the maintenance supervisor to be giving him a signal to taxi. The maintenance supervisor, however, had noticed the APU power cord was still attached to the aircraft. He began running toward the aircraft to stop it, repeatedly crossing his hands rapidly over his head. The aircraft moved forward, damaging the aircraft's fuselage and the auxiliary power unit.

• A DC-8 captain observed a ground attendant approaching the aircraft with wheel chocks in his hand. He assumed the aircraft would be chocked. The ground attendant held the chocks up to the pilot but received no signal from the captain that he desired the chocks to be used. With the aircraft unchocked, when the captain released the brakes, the aircraft started to roll and struck a passenger loading stand.

The moral—military and civilians alike can fall prey to that age-old predator "a failure to communicate." Marshalling instructions must be standardized and used properly. As a pilot, if you are not sure what the situation is—don't move until you are sure. Taxi accidents are embarrassing and costly.

HIGH AND HEAVY

The first practice approach for the T-37 was planned as a no-flap ASR at Peterson AFB. The approach proceeded normally until the flare, when the pilot reduced power to idle and increased his pitch attitude for landing. Airspeed decreased rapidly, and at approximately 100 knots, stall buffeting began. The throttles were advanced to 100 percent rpm and flaps were lowered, but neither action was initiated in time. The T-37 touched down tail first, just past the approach end of the runway. The aircraft sustained tail cone damage and a jammed rudder. The reasons—failure to recognize the power requirements for a heavyweight approach, coupled with higher stall speeds for the no-flap configuration and the engines' inability to accelerate quickly enough in that high pressure altitude environment. You must be familiar with the early stall warnings of your aircraft and, when necessary, be able to make a timely decision to get the power in and go-around. ★

USAF IFC APPROACH



The USAF Instrument Flight Center welcomes your inquiries regarding instrument flying. We feel that no question should be left unanswered and encourage your letters, phone calls, and visits. The following are some of the questions that we have received from the field which we would like to pass on for the benefit of all pilots.

GENERAL

Q: Does the emergency safe altitude published on an Instrument Approach Procedure give me 2,000' above the highest obstacle in designated mountainous terrain?

A: Yes. However, remember that designated mountainous terrain includes only those areas shown in the FLIP Area Planning (AP/1, 2, & 3) designated mountainous area depictions.

Q: What are minimum and Emergency Safe Altitude measured from?

A: For **Minimum Safe Altitude,** a 25-mile radius from the navigational facility, e.g., NDB, VOR, TACAN, except in the case where the facility is more than 25 miles from the airport. Then the minimum safe altitude may be based on a radius of 30 miles from the airport. When the procedure does not use an omnidirectional facility, e.g., LOC BC with a fix for the FAF, the primary omnidirectional facility in the area will be used. **Emergency Safe Altitude** is established within a 100-mile radius of the navigation facility.

Q: Why do the High Altitude Enroute—US Charts have low altitude VORTACs depicted in both light and dark blue?

A: The (L) VORTACs depicted in dark blue comprise a portion of the high altitude enroute structure and have been flight checked for the expanded service volume necessary for high altitude facilities. The low altitude facilities shown in light blue are for information purposes only.

PRE-FLIGHT

Q: What does a fuel reserve include and how do you compute the fuel reserve with an alternate required?

A: The fuel reserve specified in AFR 60-16 is the

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By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

required fuel to increase the total planned flight by 10% or 20 minutes, whichever is greater. This total planned flight time includes the approach and landing. When computing the fuel reserve with an alternate required, the computations are based on the manner in which you filed.

a. If **Visibility Only** criteria are used for filing to the destination, fuel computations will be based on total time to alternate including penetration/approach/missed approach at the original destination.

b. If **Ceiling and Visibility** criteria are used for filing to a destination, fuel computations will be based on total time to the alternate, **not including** penetration/approach/missed approach at the original destination.

Q: With only one VOR in the aircraft, where should the VOR receiver check be accomplished? Can part of the check be accomplished in the chocks?

A: VOR receiver checks should be accomplished at a designated ground check point, if one is available. Normally, the entire check should be accomplished at this point; however, only those items requiring specific course/DME information are required to be checked here.

DEPARTURE

Q: When established on a SID, the controller states, "Cleared to FLXXX." Does this delete the published altitude restrictions on the SID or the altitude restrictions previously issued by the controller?

A: Yes. According to FAA Handbook 7110.65, if the controller desires to make an altitude restriction still applicable when issuing a new altitude clearance, he must restate the applicable altitude restriction(s) in the new clearance.

ENROUTE

Q: If my clearance limit fix has a charted holding pattern, but it is on the opposite side of the fix from my arrival side, should I hold on the course from which I arrive or in the charted holding pattern?

A: ATC should issue holding instructions five minutes prior to arrival regardless of whether or not a holding pattern is charted. Without holding instructions, hold in the charted holding pattern, regardless of which side the holding fix is on. If one is not charted, hold in a standard pattern on the course which the aircraft approached the fix.

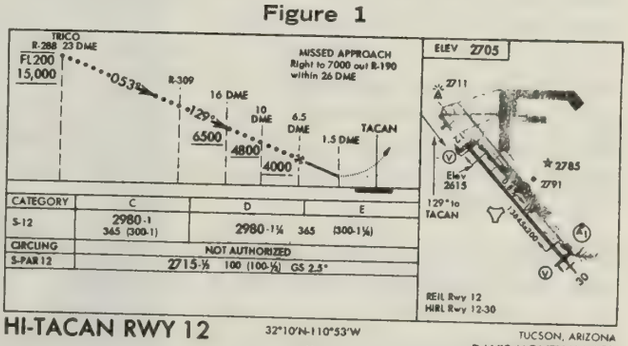
Q: Can I file and use a TACAN facility not in the high structure when flying in the high structure and going to the entry point of a low level training route that is located near the low facility?
A: Yes. FLIP General Planning authorizes the use of low facilities when navigating to and from the Jet Route System.

Q: After initial entry to the holding pattern at a TACAN holding fix, can I proceed direct to the holding fix on my initial turn inbound, using fix-to-fix navigation?
A: Yes, but if your aircraft has no wind drift detection equipment, then a good technique is to intercept the course inbound to determine the wind effect as soon as possible.

Q: A VOR approach has a stepdown fix on final which is formed by a VORTAC radial and dual VOR minimums are published. Can a pilot use the TACAN portion of the VORTAC to identify the stepdown fix?
A: Yes, as long as the IFR Supplement or the approach plate list no restrictions to the use of the TACAN.

Q: An approach depicts the altitude at the IAF as $\frac{\text{FL200}}{15000'}$ as shown in Figure 1. If I am holding at $\overline{18000}$ and I am cleared for the approach, can I descend to 15000?

Figure 1



A: Since there is no minimum holding altitude published, you cannot descend prior to reaching the IAF without an Air Traffic Control (ATC) authorization to do so. If you desire, request approval from ATC.

IFC Approach continued

ARRIVAL

Q: New USAF procedures (AFM 51-37) state you may circle either direction unless otherwise directed by a controller or stated on the Instrument Approach Procedure (IAP). Is this in conflict with the Federal Aviation Regulations (FARs)?

A: No. Maneuvering to left base, as directed in the FARs, was intended for VFR entry to the visual traffic pattern.

Q: What adjustments to minima should a pilot make when notified that the approach lights are out at his destination?

Figure 2

CATEGORY	A	B	C	D
S-7 *	400/24 391 (400-½)		400/40 391 (400-¾)	400/50 391 (400-1)
CIRCLING	520-1 510 (600-1)	560-1 550 (600-1)	560-1½ 550 (600-1½)	560-2 550 (600-2)

* The following applies without ALS, Cat ABC RVR 50 visibility 1. Cat D visibility 1½.

A: Pilots should make no adjustment to published minima unless directed to do so, e.g., TACAN Rwy 7, Langley AFB, VA, Figure 2, by NOTAM, or informed of a change to minima by ATC.

Q: AFM 51-37 states that when executing a missed approach, pilots should wait for a positive climb indication before retracting flaps. The flight manual for my aircraft says to retract flaps immediately. Which is right?

A: AFM 51-37 provides general guidance. In this case, the Flight Manual would prevail.

Q: If assigned an altitude of 3000' and the approach begins with an altitude of 3000', do I still call vacating 3000' when cleared for the approach?

A: Yes. Report when vacating an assigned altitude when cleared for an approach as required by FLIP General Planning.

Q: Should I fly a heading on a DR segment of an IAP or apply a wind drift correction and attempt to fly the depicted track?

A: Apply the best known wind to obtain a wind drift correction whenever possible. Your objective should be to fly the ground track as closely as possible to assure yourself of maximum obstacle clearance.

Q: Does the procedure of timing 15 seconds for each 1000 feet below recommended altitude apply to all penetrations?

A: No. Normally, timing a "fly-off" applies only to NON-DME teardrop procedures where no means of fixing your position is available after departing the IAF. By using the "fly-off" procedure of timing 15 seconds for every 1000 feet you are below the IAF altitude, you are approximating the distance out-

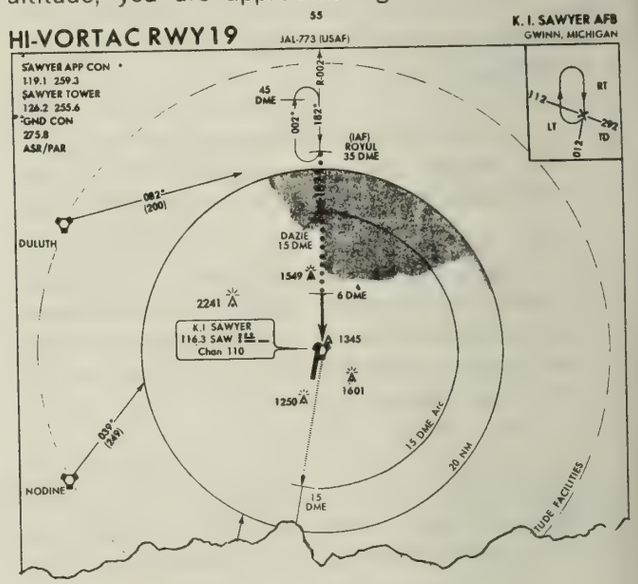


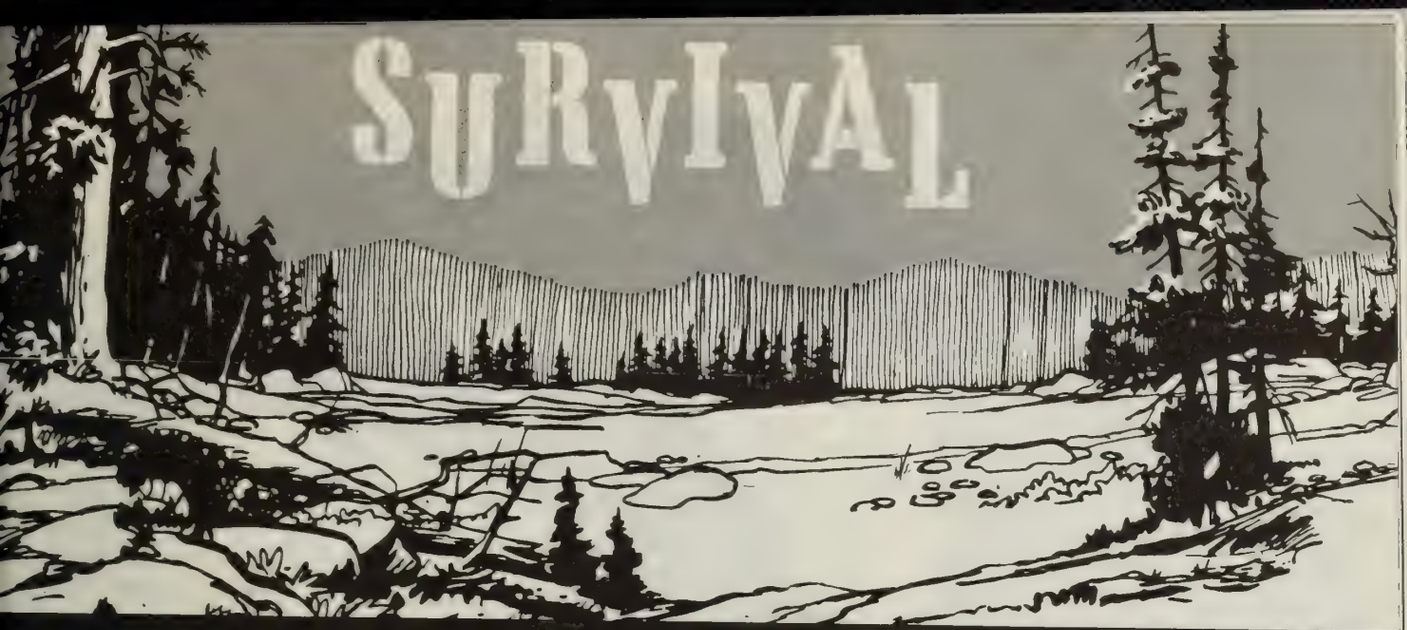
Figure 3

bound you would have been had your descent started from the published IAF altitude. When DME is available, as in Figure 3, there is no need to time a "fly-off." Using DME, you can accurately determine your position and compute the needed rate of descent to comply with the published procedure.

Q: If circling for landing and I lose sight of the runway, should I proceed directly to intercept the missed approach course?

A: No. An initial climbing turn should be made toward the runway until intercepting the missed approach course. If the initial turn were away from the runway, you could transit airspace not cleared for obstacles. ★

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Invitation To Survive

SSGT ALFREDO VARGAS
Operations and Requirements Branch
3636 Combat Crew Training Wing (ATC)
Fairchild AFB WA

It was a crisp arctic Monday morning when Survival Instructor, SSgt Tom Lutyens reported for work. He was eager and ready for the day's events because today was his scheduled ride in an O-2.

Nothing seemed out of the ordinary as Chief Master Sergeant Dustin, the NCOIC of the Det 1, 3636 CCTW (ATC), Arctic Survival School, called him in and asked him if he was ready to go. Then Tom was handed "THE LETTER." It read, "On this day, while flying in an O-2, you encountered emergency conditions which forced you to crash land. The aircraft burned after crash." The letter also included a list of occurrences clearly establishing a scenario for a survival episode.

Things happened fast! Two of his fellow instructors escorted him to a remote area of the Yukon for the exercise. Suddenly he was alone, and the 15 degree temperature, pushed by a gentle breeze, drove home the full impact of his situation. Here he was, knee deep in the snow, holding an A-3 bag containing a parka, winter flying suit, and an O-2 Survival Kit; and he had to survive.

Realizing the weather called for immediate action, Tom traveled until he came to a root buttress near an open area. The spot was an ideal shelter site and the root



buttress could serve as one of the walls for the shelter. The nearby clearing also provided a good spot to set out a signal that could be seen from the air. Knowing an aircraft could fly over at any time, Tom immediately prepared two of his Mark 13 flares by cracking the seals and then replacing the plastic caps. His next priority was the construction of a shelter. Using only natural material, Tom built his survival house in four hours, complete with a six-inch thick bough bed.

By midafternoon, the sun broke through the heavy overcast. Tom opened his sleeping bag container, shook the bag vigorously, and laid it on a dry stump in the sun. Tom knew, if he was going to sleep warm, the down-filled bag needed to be fluffed and dried before he used it.

Dehydration was now becoming a problem, as Tom answered a call of nature and observed the color of his urine. Cold acts in subtle ways as it draws moisture from the body, and Tom responded to it by gathering the necessary materials and starting a fire. Having no suspension line, he took



A natural shelter against a root buttress.

the tourniquet from the medical kit and made a loop around three poles about six feet long, creating a tripod from which to suspend a snow-melting bag. This was fashioned from his T-shirt by stitching the lower hem together with a needle and thread from the part 1 medical kit. The bag was filled with hard-packed snow and hung by the fire to melt. Water created from the melting snow was caught in one of the cans from his general purpose rations. Having solved the water problem, Tom began preparing a meal from his rations.

He improvised a cook pot from another of his ration cans, and then cooked and ate three tins of soup. This, together with a cereal bar, helped to restore the energy that had been depleted during the day's strenuous activities.

All day, Tom had consciously tried to conserve energy, but the number of necessary tasks to be accomplished made it difficult to do. Now with a fire crackling, he sat down to relax and dry out his clothing and equipment—but not before he piled some boughs next to the fire, just in case an aircraft appeared unexpectedly. This way he would be able to pile the green boughs on the fire and send up spiraling clouds of white smoke to alert someone to his plight as quickly as possible.

As the fire dried the last of his garments, a light snow began to filter through the trees. A marked drop in temperature brought on by the setting sun inspired Tom to finish his business and crawl into his shelter for the night. Once inside, he wedged a snow-filled A-3 bag into the entrance and was able to raise the temperature from 10 to 26 degrees Fahrenheit with two candles, combined with his own body heat.

Even though the outside temperature never fell below 10 degrees, Tom experienced a very cold and totally uncomfortable night. He tossed and turned continuously, trying to warm his hips, shoulders and feet. He was wearing "long handles," wool socks, and a wool toque that covered his head and neck. He placed a mitten under his hips and shoulders to help pad them and provide insulation. To warm his feet he added another pair of wool socks, making sure they were loose enough to permit adequate circulation. He finally got warm enough to fall asleep when he placed his parka under his upper body, covered his body with his winter flying suit, and performed some isometric exercises.

He awoke at 0615 with his toes feeling like ice. He got dressed, crawled out of his shelter and started a fire to warm his hands and feet. Breakfast consisted of hot cocoa, a cereal bar, and a fruitcake bar. He then settled back and began to make a mental checklist of things that had to be done. At the top of his list was to build an even thicker bough bed. The other priorities were necessarily vague because he had no idea how long he would be in this situation. He knew he had to take care of his immediate needs, and planned his day accordingly.

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It was approximately 0830 when the sound of a helicopter broke his train of thought. He took out his PRC-90 Survival Radio from its warm storage in the pocket of his flight suit and simultaneously placed boughs on the campfire producing a column of smoke. While Tom's initial radio transmission was not answered, the aircraft did respond by coming into the area. Spotters in the aircraft located Tom easily as the orange smoke from the ignited Mark 13 flare drifted skyward.

Persistent attempts to communicate via the radio finally resulted in garbled acknowledgements. All Tom could understand was "800 feet," but from that information he figured they wanted him to move 800 feet in the direction the chopper was flying — northwest. His role as a downed aircrew member reached its emotional peak as he started to run in the knee deep snow toward the area indicated by the chopper. He quickly tired. and finally reduced his pace to a walk; in a few minutes he was in a small clearing. The aircraft came to a hover, and again its sound drowned out radio communications; however, hand signals by the pilot and the subsequent movement of the helicopter affected communications resulting in a lowering of the pick-up device for SSgt Lutyens to use.

After getting the "come ahead" signal, Tom approached and kicked the penetrator to ensure that it was grounded. Being a strapping lad, (6 feet 7 inches tall) Tom had some difficulty getting the strap over his head and shoulders, but he clearly proved it can be done. He mounted the seat, keyed the radio and told the aircrew to hoist away, and then shook the cable vigorously to make sure they got the message.

After the helicopter deposited SSgt Lutyens at the Arctic Survival School Command Post, he reflected on his experience and made the following comments:

a. Training in cold weather survival being provided by the "Cool School" is sufficient in every aspect.

b. The equipment carried by an O-2 pilot is good with the exception of the SRU-15/P (compressed sleeping bag). It did not keep his feet warm and it is much too short for anyone over six feet tall.

c. Improvement of the sleeping bag by adding a foot sack or booties from the walk-around sleeping bag would provide the necessary insulation to keep a survivor's feet warm.

d. Use of the earphone with the radio is a must, especially during the recovery phase.

e. Operation of the survival radio should be kept to a minimum while underneath the rescue helicopter during hoist recovery, because it interferes with radio communications on board the aircraft.



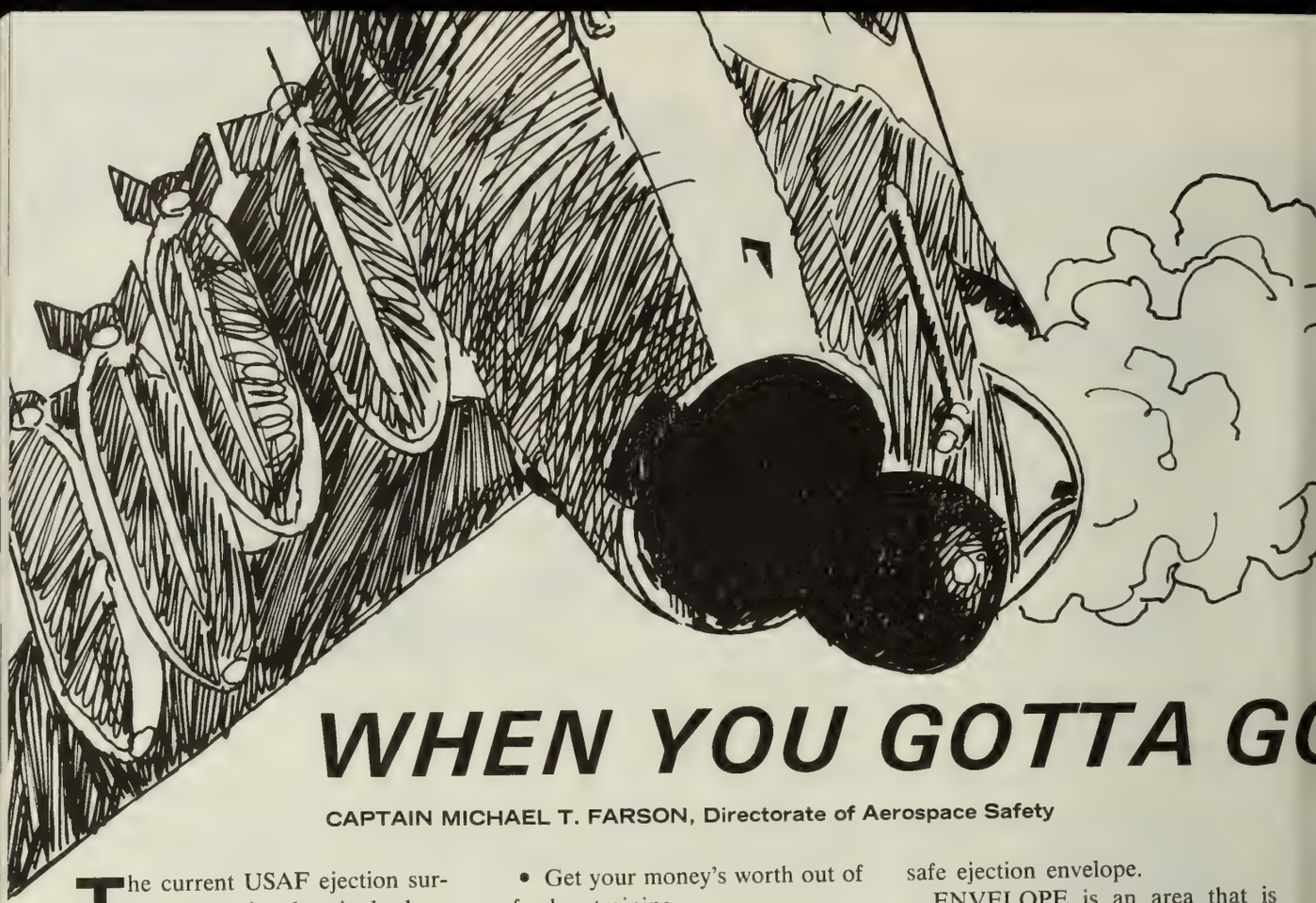
Smoke and signal in clearing make rescuers' job much easier.

Survival radio, smoke from previously prepared fire assist rescuers. Photo is out-of-date but the principles remain the same.



The experiences and comments of SSgt Lutyens reflect the current state of the art in survival training. It is a constant striving to test the equipment, the procedures, the techniques, and ultimately, the person, as we improve the chances of every aircrew returning from an emergency bailout or crash landing. More information on similar survival episodes will be forthcoming in future articles.

Information or comments concerning these articles should be referred to 3636 Combat Crew Training Wing/DOTO, Fairchild AFB WA 99011, or AUTOVON 352-5470. ★



WHEN YOU GOTTA G

CAPTAIN MICHAEL T. FARSON, Directorate of Aerospace Safety

The current USAF ejection survival rate is alarmingly low. Coupled with the poor figures for 1976, ejection survival is a cause for considerable concern. This article will briefly cover what you, as crew members, can do to improve your chances of surviving an ejection.

To cover a few of the important areas that are involved in the ejection decision we will use EJECT as an acronym. Education, Judgment, Envelope, Crew involvement, and Timing.

EDUCATION is the basic ingredient in any successful ejection. Education and training provide you with the information you need to properly use your aircraft's ejection system. There are several things you can do to keep the odds of survival in your favor:

- Know your aircraft's performance limits.
- Know your egress system's performance limits.
- Know your own limitations.
- Review emergency egress procedures frequently.
- Get your money's worth out of refresher training.

Armed with this information you should be able to determine some valid ejection decision points for you, your aircraft and your egress system. These decision points will be the guidelines you need to make a sound ejection decision if the need ever arises.

JUDGMENT is usually used as an all encompassing term, and that's how we'll use it here. It involves how well you use the equipment, knowledge, and skill you have at your disposal. Perhaps a cold, calculating look at several areas is in order:

- What are the high risk areas for your weapon system?
- Are you ready for some of the more demanding regimes?
- Are you ready to act on your ejection decision points?

The above list is by no means complete, and I'm sure with some thought you can expand it greatly. However, thinking about the items covered may help you to make your decision while you are still in the safe ejection envelope.

ENVELOPE is an area that is very important to you. Out-of-the-envelope (O/E) ejections have historically accounted for most ejection fatalities; in fact, 54% of the ejection fatalities in the last five years have been O/E. Your training should make you aware of your egress system's limitations. This along with your judgment and ejection decision points should allow you to avoid becoming an O/E ejection fatality. In the last five years 115 crew members who could have survived died because they waited too long or didn't pull the handle. Thus O/E ejections are the area you can do something about. Don't become an O/E ejection statistic.

CREW involvement may be one of the reasons that the individuals mentioned above stayed with the aircraft past the point of no return. When the crew is involved as the cause of a mishap, the chances for an O/E ejection increase greatly. This contrasts sharply with logistics caused mishaps which have the low-

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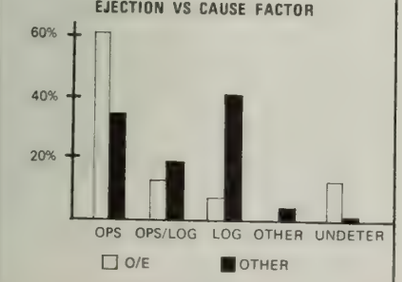
.....KNOW!

est O/E ejection experience. Put another way, if the aircraft enters uncontrolled flight due to pilot error, then the crew is more likely to stay with the aircraft longer, and thus more likely to eject O/E. The crew has a tendency to try just one more thing before punching out; and that one more thing can be fatal. Logistics caused mishaps are a different story. The crew is much less likely to stay with an aircraft with a serious material failure. They can't save it—so they get the hell out instead of trying one more thing. This leads naturally to the next point. (Table 1)

TIMING is also essential to ejection survival; it involves a combination of the topics discussed earlier. However, the bottom line is—it doesn't do any good to decide to eject after you've hit the ground. Thus you must combine all the things we discussed earlier plus your analysis of your present situation to make a timely decision. Since we touched on delays earlier, let's look at their effect. A review of the last five years O/E ejection history revealed:

- Accident boards were able to determine the delay interval about two-thirds of the time.
- Delay intervals were in excess of reasonable reaction time (3 seconds) more than half the time. (Table 2)

TABLE 1.
EJECTION VS CAUSE FACTOR



NAME THAT PLANE ANSWER

REPUBLIC P-47

The P-47 was the direct descendant of the Seversky P-35. A technically superior, state-of-the art aircraft, the "JUG" was twice as heavy as any single-engine fighter built to that time. It had the reputation of being the toughest fighter of the war, with the ability to take a tremendous amount of punishment.

TABLE 2.
OE/EJECTION VS DELAY INTERVAL
1972-1976

DELAY	NO.	%
3 SECONDS OR LESS	5	11
4 SECONDS OR MORE	23	52
UNKNOWN	16	36
TOTALS	44	99

- Accident boards had a harder time determining the reason for the delay.
- "Trying to overcome the problem" i.e., regain aircraft control, was the reason for a significant number of delays. (Table 3)

TABLE 3.
O/E EJECTION DELAY VS REASON
1972-1976

REASON	NO.	%
TRYING TO OVERCOME PROBLEM	15	34
DID NOT RECOGNIZE EMERGENCY	2	5
UNKNOWN	22	50
N/A	5	11
TOTALS	44	100

Another analysis indicates that of 181 crew members who didn't eject, 71 had sufficient time to initiate egress. (Table 4)

TABLE 4.
FATALITIES WHO DIDN'T EJECT
VS
TIME AVAILABLE FOR DECISION

	TIME FOR EJECTION DECISION		
YEAR	SUFFICIENT	INSUFFICIENT	UNKNOWN
1972	29	26	3
1973	5	21	5
1974	16	25	0
1975	10	13	0
1976	11	17	0
TOTALS	71	102	8

I hope you have found this brief discussion interesting. It was intended to make you aware of recent ejection trends, and increase your interest in this area. We realize that aircraft will at times be flown outside of safe ejection envelopes because of mission requirements. However, with awareness and forethought you can be ready to cope with an ejection situation. You are the ones who must become believers in the timely use of escape systems if the USAF ejection survival record is to improve. ★



"CONVERTIBLE" CHOPPER OR HOW TO ACQUIRE AN "OPEN COCKPIT"

LT COL ROBERT L. GARDNER • Directorate of Aerospace Safety

On those sweltering summer afternoons when the mercury has climbed to the century mark how many of you helo drivers have wished for a nice cool air conditioned cockpit? Gee, I sure can recall crawling into a helicopter's green house with the inside temperature near 120°F, the perspiration quickly soaking my flying suit, and thinking "wouldn't it be more comfortable if that big fan overhead were directing its downwash on me."

Well, we rotary-wingers better not wish too seriously for an "open" or "air conditioned" cockpit, 'cause it could very well happen quite unexpectedly, much to our dismay. Here are a couple of examples which actually occurred to our fellow helo drivers of a sister service.

Mishap #1

The big CH-53 was pre-flighted by the copilot, crew chief and first mechanic in preparation for Search and Rescue (SAR) standby. Some four hours later the crew was alerted for a flight and a normal predeparture crew briefing was conducted. The operations officer conducted the mission and weather briefing. The crew then proceeded to the helicopter for start, run-up and taxi. All checks and operations were normal except: (1) While adjusting the CG trim, the aircraft commander noted that to adjust the number 1 and number 2 pitch indicators two increments below center on the AFCS flight director, the notches on the trim wheels were further aft than normal; therefore, the aircraft commander elected to reset the number 1 and 2 pitch indicators to the center of the AFCS flight director; (2) While performing the stick jump check, the aircraft commander noted the cyclic jumped forward when he turned off the number 2 AFCS servo, rather than aft, to which he was accustomed. However, since the stick jump was within limits he did not consider this forward stick jump significant; (3) Later, following this mishap, neither the aircraft commander nor the copilot could state positively that the cyclic stick trim switch was turned back on following the AFCS stick jump check.

As the helicopter left the chocks, the aircraft commander was at the controls and the first mechanic was acting as marshaller. Just prior to reaching the taxiway the helicopter was stopped for a final walk around inspection. Due to the thoroughness of previous inspections, the crew chief motioned for the mechanic to come aboard the aircraft rather than complete the walk around.

As the first mechanic approached the helicopter from the right side, the main rotor blades chopped into the top forward portion of the fuselage.

At the time of impact the helicopter was stopped, heading 320 degrees, and the winds were 220 to 240 degrees with a velocity of 11



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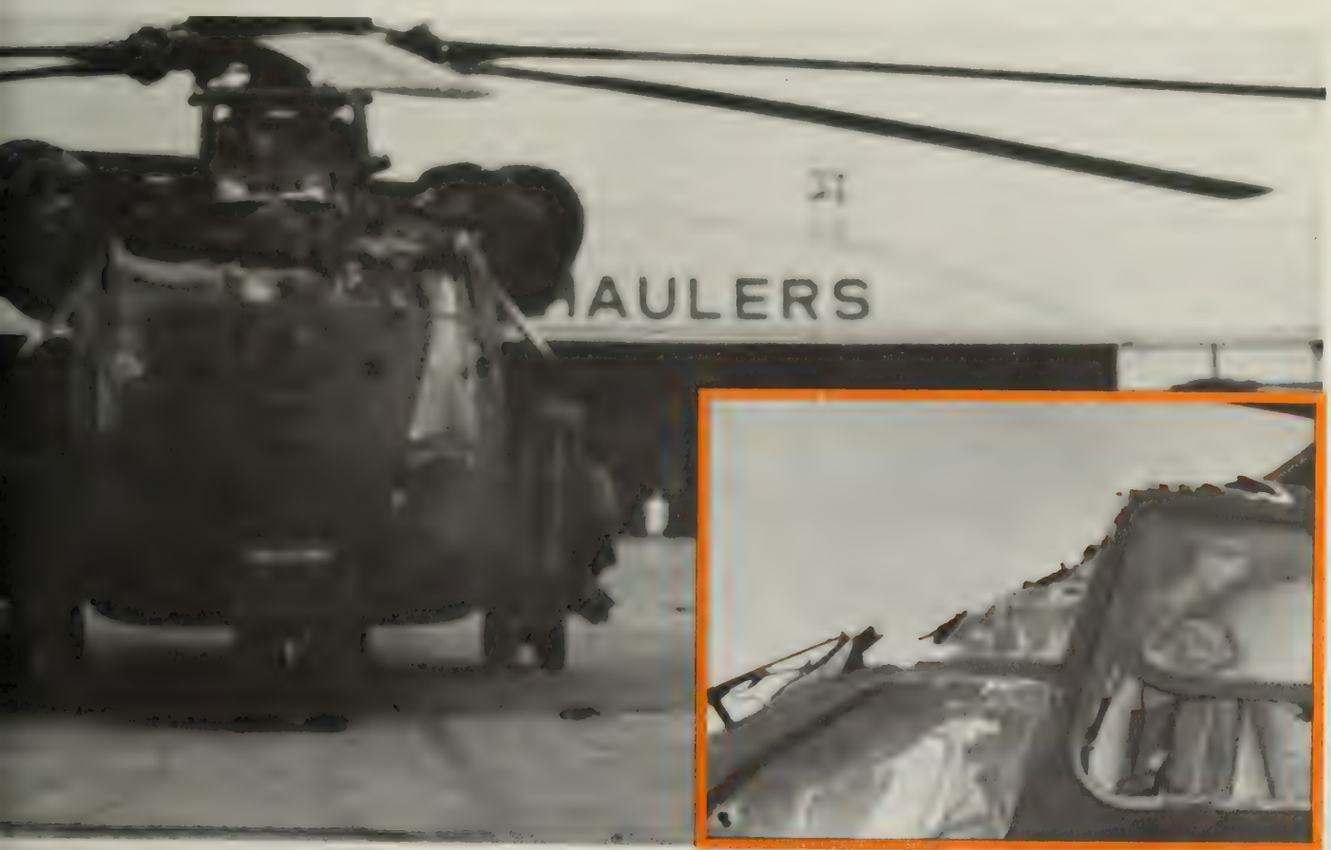
knots variable to 24 knots. Just prior to the mishap the copilot was looking left to clear the aircraft on the taxiway, and the aircraft commander was looking right observing the first mechanic approach the aircraft. As the copilot's eyes returned to the cockpit he observed what he felt to be excessive forward cyclic and the cyclic still moving forward. Before he could react to the situation the rotor blades struck the number 2 EAPS, continued through the forward doghouse and cockpit, destroying the overhead control panel and knocking the number 1 EAPS barrel completely off the engine. The windshields were cut off evenly above the instrument panel with the lowest point of the cut at approximately the middle of the center windshield. The copilot was pushed to his left by debris and sustained minor cuts to the right side of his face. The pilot also sustained minor facial cuts on the right side.

Following the impact, the aircraft commander pulled the cyclic stick aft abruptly and both pilots held the stick in the neutral position. With the overhead control panel destroyed, the aircraft commander attempted to secure the engines by pulling the remaining cables, but without success. The pilot then instructed the crew chief to shut the engines off manually, which he did by turning off the fuel shutoff valves in the cabin.

Although material failure was suspected, a thorough check of the entire flight control system disclosed no malfunctions. After extensive investigation, the board concluded that the following events, combined with the wind, resulted in the mishap.

On entering the helicopter, the pilot in command did not adjust his seat from the full forward position, and thus his observation of neutral cyclic stick, upon which the CG trim wheel adjustment is made, was altered, possibly forward of neutral. In this case, the cyclic stick being too far forward caused the triangle and the bar on the flight director to be higher than normal. Thus, when the pilot attempted to trim his normal two increments below neutral, he found that a full aft trim wheel adjustment was required. Feeling uncomfortable with this setting, he then advanced the trim wheels until the triangle and the bar were in the neutral position. This would have had the effect of lowering the tip path plane.

At the time of the accident, the copilot was looking left to clear the taxiway, the pilot and crew chief were looking right, observing the mechanic come aboard. The aircraft commander may have inadvertently pushed the cyclic forward thus creating a dangerous situation without anyone realizing it until it was too late. In addition, neither pilot could positively remember putting the stick trim back on after the AFCS stick jump check. If the pilot as-



"CONVERTIBLE" CHOPPER OR HOW TO ACQUIRE AN "OPEN COCKPIT" continued

sumed that the stick trim was on, he may very well have depressed the stick trim release button on the cyclic prior to moving the cyclic stick each time, and thereby not realized that the stick trim was off. Thus, just prior to the mishap, he may have held the stick more loosely than normal, perhaps allowing it to slide forward. Upon turning back into the cockpit, he would have grabbed for the moving stick. A slight forward motion would, coupled with the variable wind, have been the aggravating factor which caused the damage.

Mishap #2

A CH-53 was scheduled for VIP backup and logistics flight. Briefing, pre-flight, turnup, and launch were described as normal by the crew. Following delivery of an externally slung load, the helicopter departed the drop zone with the external pendant remaining attached and hanging below the aircraft. At this time the crew chief requested that the helicopter be landed to make it easier to pull the pendant into the aircraft. The pilot and copilot discussed where they should land and decided on a hilltop at their 11 o'clock position. The copilot, at the controls, executed the approach coming to a hover approximately 10 feet from the top of the hill.

The landing was commenced with the nose of the helicopter pointing up an approximate 9 degree slope. The touchdown was smooth and deliberate, brakes off, with either the main landing gear alighting first or a three point landing. At this time, the copilot stated, he lowered the collective and felt the aircraft start to roll backward. He simultaneously applied brakes and forward cyclic when a loud crack or bang was heard and the cockpit filled with flying debris. Both the pilot and the copilot attempted to cover their faces with their hands. The pilot then grabbed the controls and applied brakes regaining control of the aircraft which had started a rocking motion. With the overhead quadrant inoperative, the crew decided that the crew chief would disconnect the fuel line leading to each engine fuel control to shut down the helicopter. This was done and the crew egressed once the rotors coasted to a stop.

In this mishap the aircrew selected an adequate landing zone, but then selected a poor touchdown site within the zone, not recognizing the degree of slope in that area. The pilots landed with the brakes unlocked to an up slope site and lowered the collective allowing the big helicopter to start rolling backwards. The copilot's reaction was simultaneous application of the brakes and forward cyclic combined with the lowered collective contributed to low flapping blades over the nose of the aircraft resulting in the blades striking the forward pylon and cockpit.

Both of these mishaps illustrate how a combination of factors, each by itself not serious, can take the top out of your helo and ruin your whole day. In both of these cases the pilots involved failed to recognize a potentially dangerous situation. The lesson to be learned is that aircrews must know the limitations of their air machine and then be aware and cautious of the factors and situations which may cause those limitations to be exceeded.

Our Air Force H-53 flight manual contains several warnings and cautions concerning the hazards of excessive cyclic and low collective settings and instructions not to release the cyclic stick with rotors turning. Although the slope landing data is limited, our dash one alerts us to the possible rotor blade-to-fuselage contact. Unfortunately, those warning and caution notes are probably the result of our experience of "chopping the top" on some H-3 helicopters in the past. Although we fling-wingers are one of the few in the Air Force who can still boast of legally flying low and slow, going for the "open cockpit" is carrying things a little too far. ★



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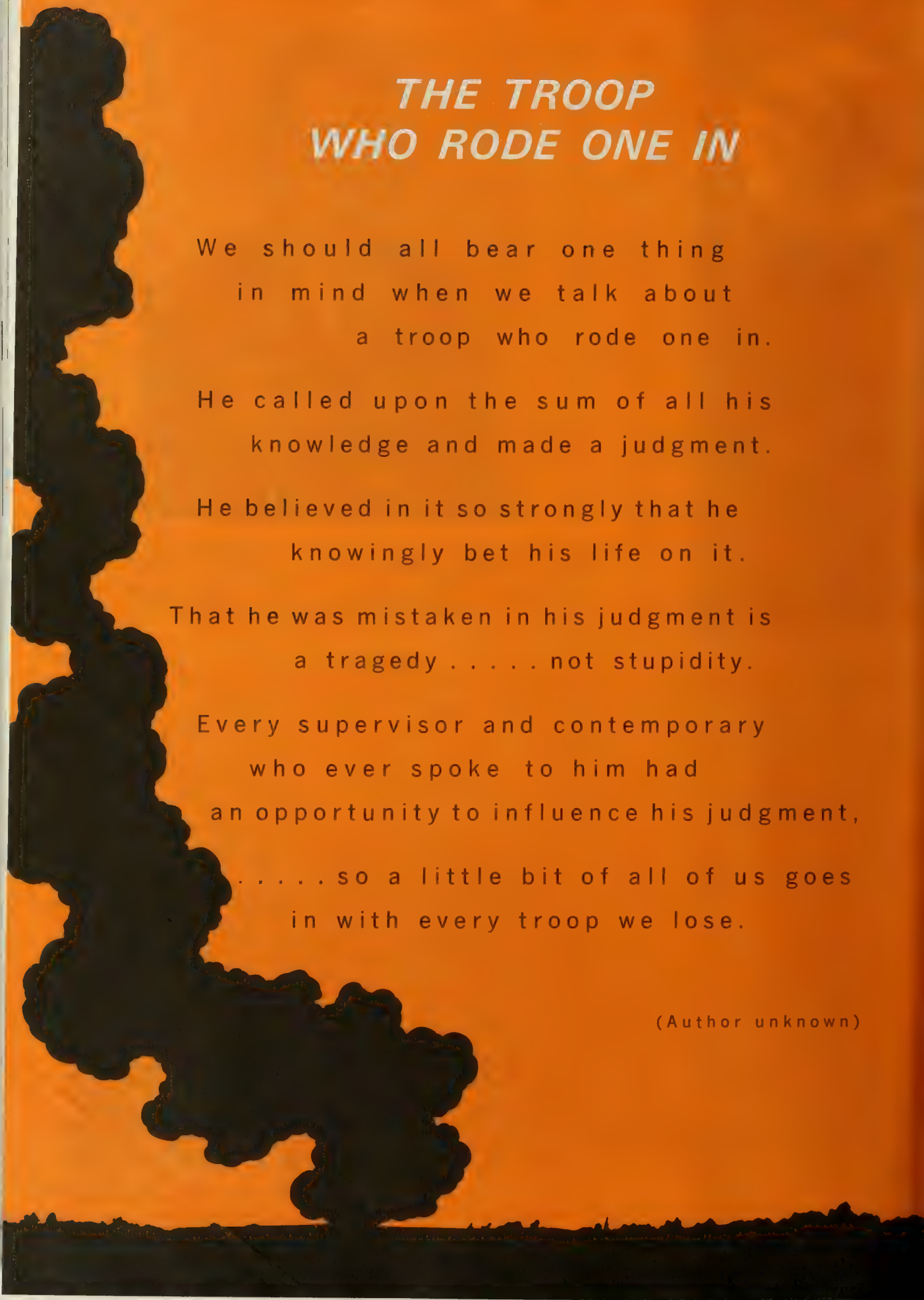


MAJOR ALEXANDER H. MURCHISON, III

27th Tactical Fighter Squadron • 1st Tactical Fighter Wing
Langley Air Force Base, Virginia

On 4 February 1977, Major Murchison, flying as number two on a four-ship F-15 training mission over the Atlantic Ocean, was scheduled to conduct air combat tactics involving multiple engagements. During the first engagement, while accelerating in full afterburner, Major Murchison heard a loud explosion from the right aft section of the aircraft. He immediately came out of afterburner, checked the cockpit instruments and noticed the right engine fire warning light was on. Major Murchison terminated the engagement and headed the aircraft toward the nearest suitable airfield, Langley AFB. As he began emergency procedure for an in-flight fire, the fuel hot and bleed air overtemperature warning lights illuminated, and the aircraft began an uncommanded nose-up roll to the right. As the roll continued, the nose dropped, and the aircraft entered a nose low out-of-control spiral. After two uncontrollable rolls, Major Murchison recovered the aircraft and was able to maintain level flight by using hard left rudder and right aft stick. High frequency vibrations continued as he completed the emergency procedure for an engine fire. The flight lead visually confirmed the aircraft was on fire and notified Major Murchison that the tail hook was down. Attempts by Major Murchison to raise the tail hook were unsuccessful. Then the environmental control system warning light illuminated. To prevent it from overheating and a possible fire from the aircraft electrical components, he turned off the radar and other high drain electrical systems and requested that a SAR mission be activated since the probability of ejection appeared imminent. After several minutes, the fire warning light began flashing indicating that the fire had been reduced to an overheat condition, which was confirmed by the chase aircraft. Next, the flight control augmentation system dropped off of the line and would not reset. After doing a controllability check, Major Murchison decided he would be able to land the aircraft with the degraded flight controls available. An uneventful single engine, straight-in approach landing was made. The outstanding flying skill and good judgment displayed by Major Murchison during this serious in-flight emergency were responsible for the successful recovery of a valuable aircraft. WELL DONE! ★

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THE TROOP WHO RODE ONE IN

We should all bear one thing
in mind when we talk about
a troop who rode one in.

He called upon the sum of all his
knowledge and made a judgment.

He believed in it so strongly that he
knowingly bet his life on it.

That he was mistaken in his judgment is
a tragedy not stupidity.

Every supervisor and contemporary
who ever spoke to him had
an opportunity to influence his judgment,

. so a little bit of all of us goes
in with every troop we lose.

(Author unknown)

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DECEMBER 1977 AFRP 127-2 VOLUME 33 NUMBER 12

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NEWS FOR CREWS

Information and tips to help your career from the folks at Air Force Military Personnel Center, Randolph AFB, TX.

CAPTAIN TOM DREIER
Rated Career Management Branch, AFMPC

During the drawdown from SEA, operations and personnel managers of the tactical fighter resource recognized the need to better quantify required advanced weapon system training. It became obvious from the onset that no single staff agency could adequately determine training requirements in isolation, and that a defensible, systematic Air Force process was essential during an era of ever increasing budgetary scrutiny. From that premise grew the Rated Distribution and Training Management (RDTM) process and a major change to the aircrew assignment system at MPC. Since both RDTM and the corollary assignment system impact aircrew assignments, an understanding of both should prove valuable in establishing achievable short range career goals.

RDTM

RDTM is a coordinated MAJCOM/Air Staff process to systematically review rated requirements over the Five Year Defense Program (FYDP), to quantify and distribute the resource available to meet those requirements, and to define necessary advanced weapon system training. Representatives from Operations, Personnel, and Manpower at the Air Staff, along with their counterparts at the MAJCOMs, meet periodically to examine the current and projected aircrew force. The Air Reserve Forces as well as enlisted aircrew representatives are active participants in the RDTM process.

Rated requirements used in this process are determined by HQ USAF, DCS/Programs and Resources applying quidance from the Office of the Secretary of Defense (OSD) to obtain the force structure required to assure a specific war-making capability. Because of the expense involved in maintaining our crews at a 100 percent wartime level, some peacetime crew ratios are maintained at a level below the wartime requirement. The difference constitutes the requirement for rated officers in AFIT, PME, and the rated supplement. These requirements, as well as generalized operations staff and a portion of the ATC instructor requirements, are "fair shared" among the ten major weapon system groups. This allows individuals from all weapon systems to share equally in the inherent career broadening and executive development aspects of these positions, while providing the respective areas with a representative cross section of the operational force.

It should be noted that changes in higher level guidance result in an altered requirements structure. This eventually impacts on career patterns an individual can expect in the Air Force. In the last few years requirements have been decreasing faster than anticipated. As a result, both rated and support accessions (the new officers brought on board) were cut drastically to stay within authorized end strengths. This created a much greater opportunity for rated officers in non-rated duties than the actual stated rated supplement requirement. The very low UPT/UNT rates of today are rapidly reducing both the rated surplus and USAF capability to place rated officers in support duties.

AIRCREW ASSIGNMENTS AT MPC

As a result of the information made available through RDTM and advanced computer capabilities, aircrew assignments have undergone some recent changes at MPC. Assignment teams with functionally qualified resource managers are now organized along the lines of RDTM weapon system groups. The teams are currently manning from the worldwide available resource directly to the wing level at most Air Force units. Each rated officer is tracked by primary weapon system regardless of where he is currently serving. Thus, each individual has a specific aircrew resource manager who makes or coordinates every assignment—even an assignment from one support position to another. As an active participant in the RDTM process, today more than ever, the aircrew resource manager can ensure that individual desires are included in each assignment, and that each assignment tracks to Air Force goals. ★

ABOUT THE AUTHOR

Captain Dreier is a graduate of the US Air Force Academy. He is a former C-141 pilot who has been assigned to the RDTM Analysis Section of the Rated Career Management Branch, AFMPC, for the past 3 years.

EFFECTIVE COMMUN

CAPTAIN JAMES J. LAWRENCE • Directorate of Aerospace Safety

Communication, in the formal sense, is a process by which information is exchanged between individuals through a common system of symbols, signs, or behavior. Let's look at this metaphorically. A dump truck has to move a load of gravel from the storage area to a construction site. Picture this storage area as the sender and the construction site as the receiver. The truck is the mode of communication, and the gravel is the information. Successful communication is dependent on the movement of the load intact from point A to point B.

Now, let's assume that the dump truck has a malfunction, say a loose tailgate, and as it travels the distance from A to B, what happens? Some of the information leaks out. B only gets part of the whole message, and maybe not enough to fully understand the intent.

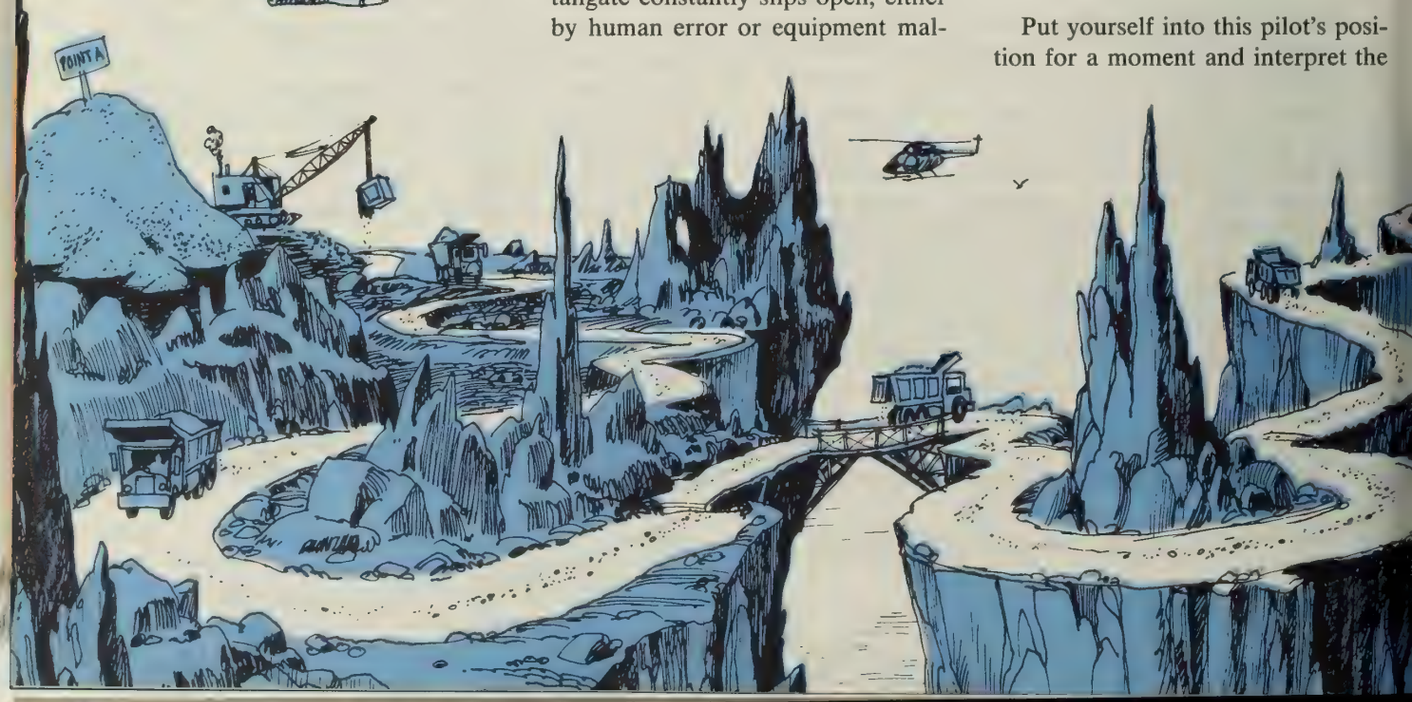
We in the aerospace business are constantly faced with this situation. Our communicative skills directly affect our ability to safely operate a multi-million dollar vehicle. Yet, the tailgate constantly slips open, either by human error or equipment malfunction. As this occurs, vital information is lost or overlooked. Communication has ceased, and the results can be disastrous.

This leak can be caused by interrupted transmissions, background noises, equipment malfunctions, inattentiveness, or just plain misunderstanding. Whatever the cause, the effect is identical; not enough communication to input the proper information for the old gray matter to compute. Result: Cumulo-granite clouds, midair collisions, unnecessary accidents, and near misses that make your knees shake and have you thinking about the adequacy of your life insurance coverage.

Case nr 1. The original clearance accepted by the pilot of a light jet called for a Standard Instrument Departure, with a right turn, then a Jet Route to destination. The clearance called for a climb to 17,000 feet MSL, exactly as the pilot filed it. Just prior to takeoff, the controller instructed the crew to maintain 9,000 feet, until further notice, because of other air traffic in the area.

Put yourself into this pilot's position for a moment and interpret the





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CATION ...You're life may depeend on it

information he received. Would you:

A. Take off and climb straight ahead to 9,000 feet, until further notice? or

B. Take off and fly the original clearance, using 9,000' as an altitude restriction, until further notice?

If your answer was A, then you, like this pilot, were destined to lose a grudge match with a mountain. The controller's intent was more like that stated in B. The proper answer is:

C. Question the departure instructions.

That dump truck leaked out an important part of its pay load, rendering the pilot's chosen action invalid and in this case fatal. The best way to close that gap and stop the leak is to be inquisitive. Analyze what you hear in relation to the factors relevant in your situation. Swallow a little pride and request more information, if what you have received isn't totally clear.

Hundreds of examples of misinterpreted ATC instructions could be cited. They occur daily. The causes could be malfunctioning radios, misunderstanding, interrupted transmissions; the list is endless. Some result in much more severe consequences than others.

Case nr 2. A transport began its enroute descent. The aircraft was cleared to 5,000' MSL. The pilot called back, "Understand cleared to 3,000 feet." This transmission was blocked out by another aircraft calling control. The transport was then handed off to Base GCA. The initial call to GCA was, "With you, passing 5 for 3,000 AF XXX." The GCA controller was issuing control instructions to another aircraft and only heard the call sign. He informed the transport to stand by. Shortly thereafter, it impacted a mesa at an altitude of 3,050' MSL, destroying the aircraft and killing all aboard except one crew member.

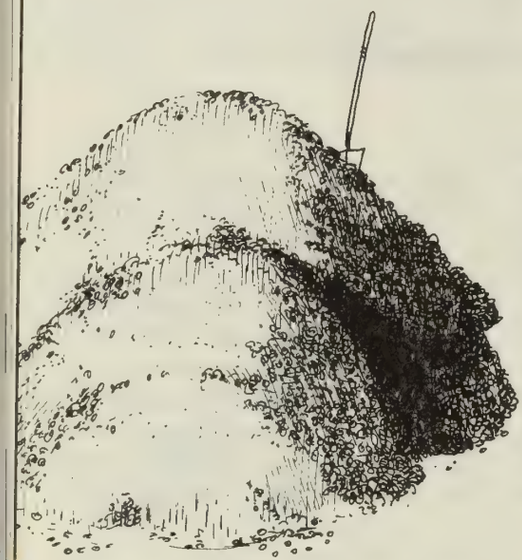
How do we avoid a mishap like this? The first obvious answer is, know the characteristics of the terrain at your destination. Sure, that's basic and this knowledge could have kept the crew from accepting that clearance without question. The communication gap, however, was just as responsible in the failure to avert this tragedy. There are some basic rules to follow that can help to avoid pilot/ATC communication errors:

1. Be suspicious of all clearances received. If they do not appear proper—question them immediately.
2. LISTEN to what is said—do not hear what you anticipate hearing.
3. Use your full call sign in every transmission to preclude misunderstanding.
4. Read back clearances IAW Airman's Information Manual procedures. That is: Call sign first—then repeat of the clearance.
5. Maintain radio discipline and do not accept less from those controlling you from the ground.



EFFECTIVE CUMMONICATION

continued





The information flow between pilot and controller is subject to gaps and leaks which can render the communicative process ineffective. These gaps must be plugged by us, the aircrew members. Realistically speaking, our risks are much greater than those of the man on the ground, so we must be the ones to demand total understanding.

To help stop these leaks, it is necessary for all aircrews to remain totally attentive to the information coming across the air waves.

Case nr 3. First contact with departure control after takeoff:
Control: ". . . (Aircraft 1) climb to 280, report passing 160."
Aircraft 1: "Roger, turn left to 280 and climb to 160." (This would put the aircraft directly on track toward high terrain near the airport.)
Control: "Roger."
Aircraft 2: ". . . (Aircraft 1) check that was a clearance to 280 and not a turn."
Control: ". . . (Aircraft 1) climb to 280, report 160."
Aircraft 1: "Thanks very much (Aircraft 2), climbing to 280."

This second aircraft was paying more attention to the information flow than was the first aircraft or the controller. His excellent attentiveness possibly prevented a major accident. If all aircrews were similarly attuned to the flow of information in all directions over their frequency, the possibility for conflict would be reduced. This is especially true for transmissions concerning descents, climbs, or assigned flight levels for other aircraft that cross through your present altitude. To properly monitor such transmissions, military aircrews have to be on the frequency used as primary by the majority of aircraft. If you have a VHF radio, use it when working the airways or when on the ground at civilian airfields. UHF is the more commonly worked radio at military aerodromes and during arrival and departure at military fields. Monitor both, if you have the capability, but use the most frequented mode as primary so the majority of others will also hear what you have to say.

Communication between the ground and the air is only one aspect of in-flight communication difficulties. Sometimes the short distance between aircrew members represents a gap so great that all the gravel leaks from the dump truck, and there is no information flow at all. The cause can be equipment oriented or it may be directly related to the crew's unexplainable inability to communicate with the other crew members.

Case nr 4. An IP and student on a nav training mission heard a loud pop and a buzzing noise that preceded complete loss of the interphone and UHF radio. The IP, in the front seat, assumed control of the aircraft by shaking the stick. The student felt the IP control inputs but did not recognize the stick shake, which was meant to indicate transfer of control. The student continued on the controls with the IP until he felt the IP's second shake of the stick. He then relinquished control. On downwind the IP thought he felt the student on the controls and again shook the stick. The student took this as a sign to resume control. Each pilot, without being aware of it, was counteracting each others control inputs. The IP felt that loss of control was imminent and elected to eject due to the altitude being 300' below the safe controllable ejection envelope.

When the student's cockpit filled with smoke from the IP's ejection blast, he decided to abandon the aircraft.

Equipment started this crew's communication difficulties but it went farther than that. Communication is not limited to the spoken word. As I stated in the beginning, this information flow can also be through symbols. The "I've got it/ You've got it" symbol was misinterpreted by both crew members. Better pre-mission briefing prior to the radio failure could also have prevented evacuation from a perfectly flyable aircraft.

More often, however, a failure of equipment doesn't enter into the communication gap. Pilots and other aircrew members sitting virtually in each other's lap, fail to communicate thoughts, feelings and observations to their fellow crew member. They become so engulfed in their own thoughts or problems, that they neglect the need to communicate important information to others who may need it. The annals of aircraft accidents are chock full of just such omissions.

Case nr 5. On climbout, a tanker experienced a pressurization problem. A descent was requested and subsequently received down to 2,700. During the descent, communication between the flight crew and controller ended abruptly. The aircraft wreckage was sighted 20 miles northwest of the destination airfield. Two operations causal factors cited were:

1. Supervision—the instructor pilot failed to ensure safe crew coordination during a critical phase of flight.

2. Operator—the pilot flying the aircraft failed to maintain a safe terrain clearance altitude, probably due to distraction, task-oversaturation and channelized attention.

This mission was a short leg and the multitude of Air Force and Command enroute requirements, coupled with an in-flight problem, caused the communication link between crew members to completely break down. Controller voice transcripts revealed normal radio conversation right to the point of impact, indicating neither crew member recognized or communicated an error in desired altitude.

Why do you think the Air Force spends all that money to purchase extra seats in the cockpit? Four eyes are better than two. Six eyes are better than four. True. Only if the message moves from the eyes, to the head, to the mouth, to the others in the crew, so that they know what is going on. Many gear up landings and unprecipitated crashes in multi-seat aircraft can be attributed to some form of communication breakdown.

Communication is one of those staples in life that we commonly take for granted. Exchange of words or symbols has no substance unless meaning and understanding flow with the exchange. We have all feigned concentration while listening to a speaker's words, later to realize that we didn't absorb one iota of his message. Listening and understanding is an art to which textbooks have been dedicated. In our aerospace business, communication takes on special importance. Your life and the lives of your crew and passengers depends on your ability to effectively communicate. It is up to you to fix that tailgate and stop the information leak between yourself, the controller, and your fellow crew members. ★

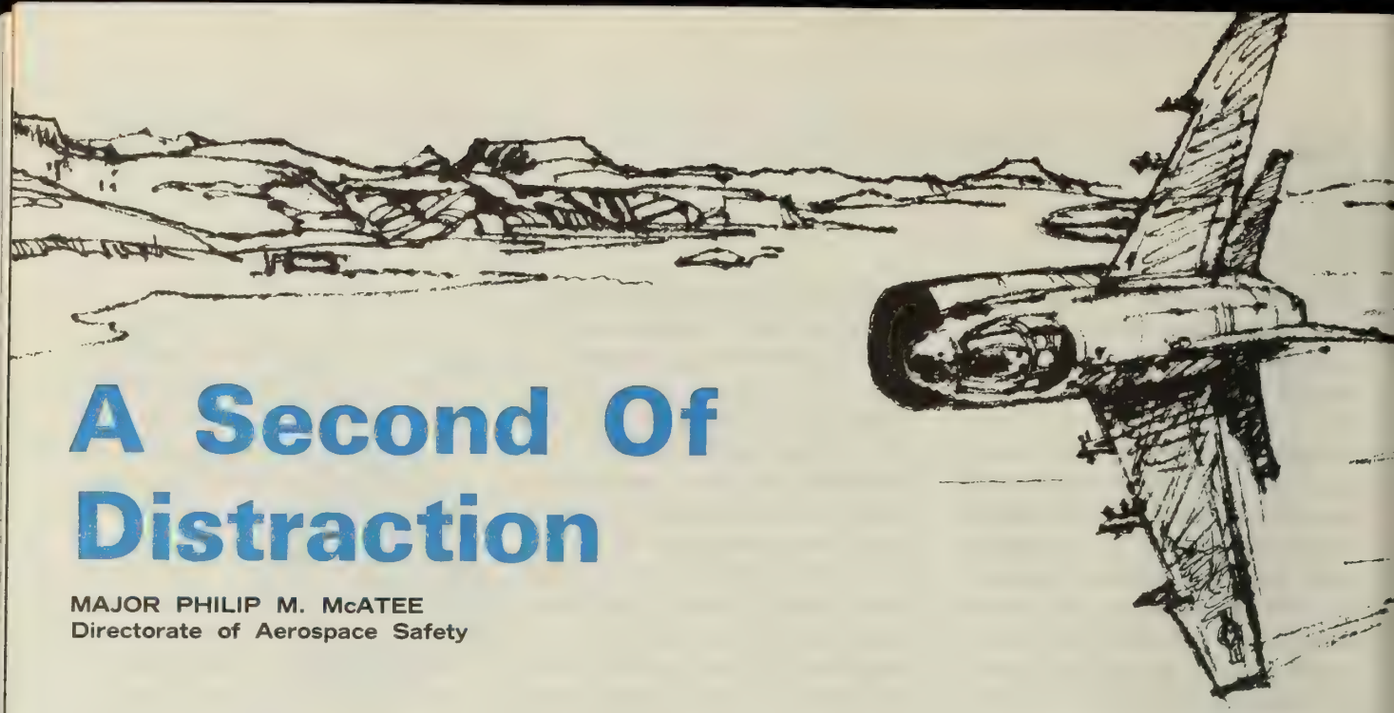
OK IS NOT OKAY!

Why not? Okay for starters let's look at one likely misuse of OK. Suppose we have an aircraft tooling along at the highest altitude in our sector or airspace at a busy time and the pilot requests a change to a specific higher altitude (not in our sector). Further suppose that our reply is "OK, stand by." Now suppose the pilot only hears the "OK" and starts the altitude change. Things could become not-so-OK in a hurry. Can't happen? It can, but it shouldn't!

Okay, to add to the problem, the controller in this theoretical incident misused OK to acknowledge receipt of the pilot's request, not to approve it. But how is the pilot to know that? If he's sharp, he'll request confirmation or otherwise realize that specific clearance to "climb and maintain" was not received. But, he may not, especially if he has become accustomed to using or receiving sloppy phraseology. Similarly, when aircrews acknowledge with "OK" it's difficult to know whether they mean "roger," "affirmative," "will comply," "that's correct," or something else.

According to most dictionaries, OK and Okay are used primarily to express agreement or approval. OK means "approved" not "stand by" and not "Message received, reply follows." But in ATC, OK is not approved phraseology, and it's not "Professional"—OK is not OK in ATC!

Okay now, this blurb on OK should be enough of a reminder to KO OK in ATC. Okay?—From FAA/ Air Traffic Service (ATS) Bulletin No. 77-4, September 1977. ★



A Second Of Distraction

MAJOR PHILIP M. McATEE
Directorate of Aerospace Safety

The mission was to be a normal four-ship search and rescue (SAR) training sortie. The wake-up and briefings were early, but early wake-up had gotten to be a fact of life in their business. The briefings were given by the flight lead and covered all facets of the mission including the special requirements and participants for the SAR. All aircraft were equipped with practice bombs, which were to be expended during the early part of the mission, and 175 gallon external tanks. The weather for the target area was expected to be good. All four pilots were well qualified, and their mission today should be "normal," if any high-speed, low-level, simulated combat mission could be termed normal. Call signs for today's run would be Nancy 01-04.

Pre-flight, start, and taxi out for Nancy 01 flight were normal. The flight had been slightly delayed by ATC, but the delay would have no bearing on the mission. The flight made a routine takeoff and proceeded on an IFR clearance to their range. Following an enroute descent the flight cancelled IFR upon entering the range boundaries and ingressed low-level in a wedge formation. Nancy 01 was in the lead with 02 in extended fighting wing maneuvering to either side. Nancy 03 and 04 were 1½ NM in trail in line abreast formation. All the practice bombs were expended on their preplanned target from pop-up deliveries.

Nancy 01 flight then began the SAR which was to be the major part of their mission. After receiving initial information from an orbiting "King" aircraft, Nancy 01 and 02 started an electronic search for survivors while 03 and 04 climbed and refueled from orbiting tankers.

After refueling, Nancy 03 contacted 01 who said he knew the general area of the survivors but had not pinpointed their location. Nancy 01 and 02 then proceeded to the tankers while 03 and 04 continued with the electronic search. While ingressing to the survivor's area in a low-level trail formation, 04 lost sight of 03. They were unable to quickly rejoin, so 04 started back to the last known position of the "Jollies" (rescue helicopters) to get them ready for the run in to the survivors. Meanwhile, 03 continued the search alone and was able to establish radio contact with one of the survivors. After two passes he was able to get a good mark on his position and continued his search for the remaining one.

Nancy 01 and 02 had by now come off the tanker and were told by O3 of the location of the first survivor. 01 and 02 went to help 04 find the Jollies, as their position was in doubt.

Nancy 03 finally established radio contact with the last survivor and was about to get an ADF bearing on him when he spotted a mirror flash from a nearby hill and turned toward it. As he approached the hill where the flash originated, he received simulated missile/ground fire and realized the flash had not been made by the survivor but by exercise enemy ground forces.

Nancy 03 immediately made a 4-5 G, 100 degree bank left turn, starting at 150 feet AGL and climbing to approximately 300 feet. He was concerned at keeping an "angular relationship" with the ground

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forces and then rolling out and repositioning.

Nancy 03 was looking toward his left, 9 o'clock to 0830 position, at the ground forces, and as he applied more Gs to keep the angular relationship, he allowed the nose to come down through the ground horizon. Since his attention was diverted to the ground personnel, he was not aware his nose had dropped more than he had intended. He rolled out, still looking back at the threat. Suddenly his attention was drawn to the front of the aircraft.

Less than 3 seconds after the roll-out Nancy 03 impacted the ground.

The preceding story of Nancy 01 flight could be any, or a composite, of several aircraft-into-ground accidents that dramatically illustrates how unforgiving the world of tactical flying can be. We all must be keenly aware of the short time available to correct a nose down pitch during high-speed, low-level maneuvers. Immediately ensure adequate terrain clearance at the first hint of distraction. Remember, during high-speed, low-level flight, the sky will not forgive even a second of distraction.

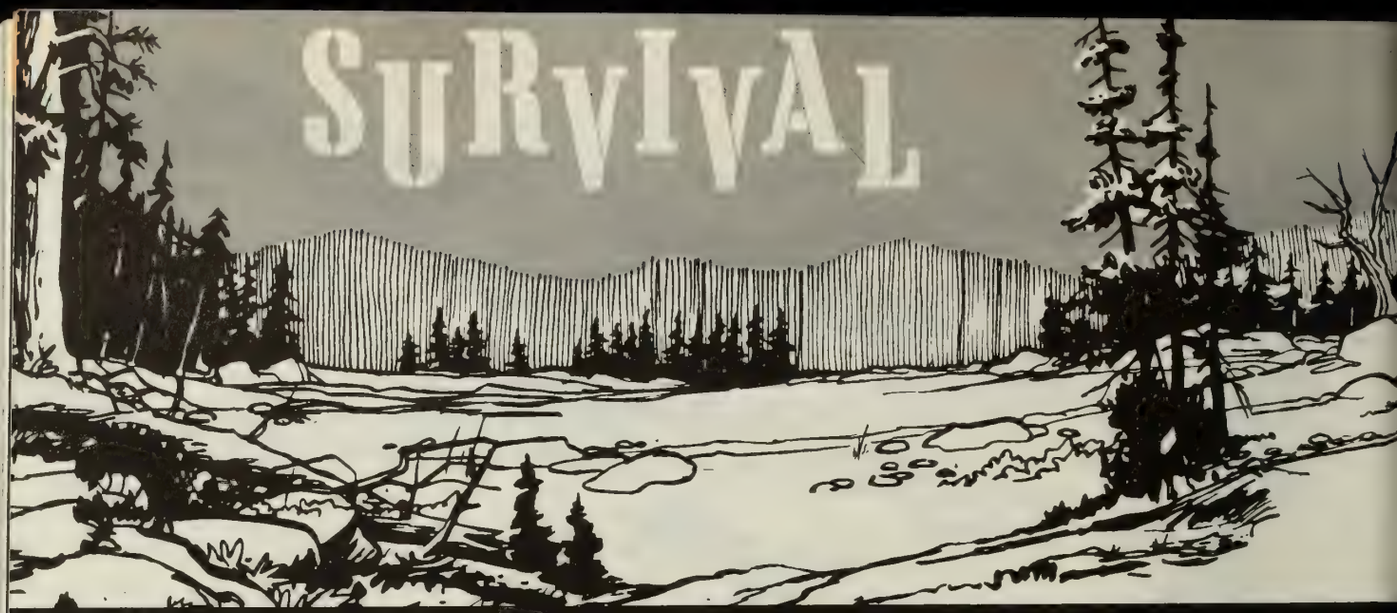
The demanding techniques required for tactical low-level flying are very well discussed in "When You Have To Go Low" by Captain John Jumper in the Spring 1977 issue of *USAF Fighter Weapons Review*. A short segment from this article dealing with low-level terms will be a helpful close.

"As we progress lower, the most difficult skill to learn or teach is the level turn. The following techniques are designed to provide constant awareness of the aircraft's nose track, relative to level flight. This is done in three distinct stages:

"1 ROLL-IN. When the turn is signalled or called, check for a visual reference 90° to the flight path. This will preclude the distraction of checking the compass, and the reference can be used for any delayed or in-place turn. The roll-in should be a rapid, unloaded roll to a bank angle which will allow the nose to track a straight line along the horizon. Obviously, we don't know what that bank angle is until we are established in the turn and can identify trends in nose position.

"2 ESTABLISHING THE TURN. In order to monitor trends in nose position, the eyes should be focused on the ground at left ten o'clock (for a left turn), so that peripheral vision includes the nose of the aircraft at one extreme and a view of the terrain being turned into on the other. As the turn progresses, this eye position allows constant cross-check of proximity to the ground vs any tendency the nose has to rise or fall. Corrections should be made by adjusting bank angle. Use of rudders is not recommended once the turn is established since your inputs will disturb our interpretation of nose position. Once a smooth nose track is established, we can briefly afford to check the progress of the turn, position of lead, and area of lookout responsibility.

"3 ROLL-OUT. Just prior to roll-out, make a final check of the nose position. If it's still good or slightly rising, roll unloaded to wings level. If slightly below the level reference, roll-out with a slight back stick pressure to break the descent. During roll-out, the eyes should shift to focus attention directly over the nose. This will allow immediate correction of any tendency to climb or descend." ★



The Smoking Pistol

CAPTAIN RONALD E. VIVION • Chief, Operations and Requirements Branch
3636 Combat Crew Training Wing (ATC) • Fairchild AFB WA

This year, at least one otherwise high quality and dedicated Air Force person will "commit suicide." Oh, the doctors won't call it that, and the term suicide won't enter into the minds of the grieving family—but that individual will have done himself in just as surely as if the smoking pistol were found next to the body. Cause of death? **Failure to survive!!** But not survival (or the lack of it) in traditional terms. This failure to survive will take place in very familiar surroundings, while the individual is doing something that is commonplace. The individual will normally be conscientious, think things through, and be endowed with a greater than normal degree of judgment. But the smoking pistol will be there.

Numerous Air Force personnel are indoctrinated in the principles of survival at the various formal survival courses run by Air Training Command. Unfortunately, they tend to be relatively narrow in their thinking about the act of keeping body and soul intact. Survival is put into the context of unplanned jumping out of aircraft, resisting enemy capture or exploitation, severe environmental factors, etc. But the pistol is cocked and loaded—all the time—everywhere, not solely in the hostile environs of combat.



This year's "suicide" victim will have received formal training in survival. He will have had continuation training at his home unit on the gear he flies with, and the procedures necessary to survive if put into the situation. The message will be remembered—but only in the context of aircrew survival. The victim will carry on all of his normal routines without a thought of losing his life—but lose it he will.

He will go for a drive in the woods, or just down the street. All the safety devices will be used, because he knows that seat belts, shoulder harnesses and head rests can save his life. But regardless, he will kill himself.

Let's bring this lethal weapon out and examine it. Its major components are forgetfulness and

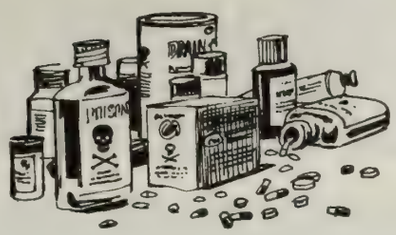
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complacency. We all know that survival gear is necessary, or else we wouldn't take extra precautions to care for our bodies when the environment is extreme. But we forget to put the extra blanket, candy bars, tire chains, bucket, shovel, etc., in the trunk of our car. Why **should** we remember when it's safe and warm in there.

To illustrate my point, consider the old man I once encountered delivering the mail into the Montana wilderness. It was during the dead of winter, and he was using a piece of over-the-snow equipment to get over his route. I noticed, quickly, that the heater in his vehicle wasn't working, and he was dressed like the "blizzard of 97" was on its way. When I asked him why he didn't fix the heater, he smiled knowingly (obviously in tolerance of a stupid question) and explained that he had purposely disconnected the heater. "After all," he said, "machines are built by men and as a result, pick the worst possible time to break. If I didn't have to dress like this to keep alive inside this thing, it would quit and no doubt kill me." He recognized the pistol, and respected it.

Of course, our modern machinery is more reliable than in years past, but people (and most





probably our suicide victim) become complacent. Remember how people crossing the great American desert used to hang two canvas water bags from their hood ornaments? Recall, if you can, the last time you saw one of those. Complacency is also found in all those families that keep bleach, poisons, paint and medicines down low—well within the reach of small children or nearsighted adults. I could go on and on with the list of potential killers around us.

The bottom line of what I'm harping at is that survival doesn't take place solely in the woods, POW camps, or at sea. It is here and now—all around us. Every act, every piece of machinery or tool, every common-place item or environment, or set of circumstances can kill you (if you work hard enough at it). Survival means keeping yourself alive and in the best condition possible. If you insist on squeezing the trigger, you will be successful in wasting your life. Or worse yet, the muzzle might be pointed at your child or loved one. So make your choice—dead by your own hand, a murderer of another person, or totally aware . . . so that the pistol never has a chance to smoke.

Questions or comments concerning the information contained in this article should be directed to 3636 Combat Crew Training Wing (ATC)/DOTO, Fairchild AFB WA 99011 or AUTOVON 352-5470. ★

REX RILEY
Transient Services Awa

LORING AFB	Limestone, ME
McCLELLAN AFB	Sacramento, CA
MAXWELL AFB	Montgomery. AL
SCOTT AFB	Belleville, IL
McCHORD AFB	Tacoma, WA
MYRTLE BEACH AFB	Myrtle Beach, S
EGLIN AFB	Valparaiso, FL
MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
MARCH AFB	Riverside, CA
GRISSOM AFB	Peru, IN
CANNON AFB	Clovis, NM
LUKE AFB	Phoenix, AZ
RANDOLPH AFB	San Antonio, TX
ROBINS AFB	Warner Robins, G
HILL AFB	Ogden, UT
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, NC
ENGLAND AFB	Alexandria, LA
KADENA AB	Okinawa
ELMENDORF AFB	Anchorage, AL
PETERSON AFB	Colorado Springs,
RAMSTEIN AB	Germany
SHAW AFB	Sumter, SC
LITTLE ROCK AFB	Jacksonville, AR
TORREJON AB	Spain
TYNDALL AFB	Panama City, FL
OFFUTT AFB	Omaha, NE
McCONNELL AFB	Wichita, KS
NORTON AFB	San Bernardino, C
BARKSDALE AFB	Shreveport, LA
KIRTLAND AFB	Albuquerque, NM
BUCKLEY ANG BASE	Aurora, CO
RICHARDS-GEBAUR AFB	Grandview, MO
RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH
CARSWELL AFB	Ft. Worth, TX
HOMESTEAD AFB	Homestead, FL
POPE AFB	Fayetteville, NC
TINKER AFB	Oklahoma City, OI
DOVER AFB	Dover, DE
GRIFFISS AFB	Rome, NY
KI SAWYER AFB	Gwinn, MI
REESE AFB	Lubbock, TX
VANCE AFB	Enid, OK
LAUGHLIN AFB	Del Rio, TX
FAIRCHILD AFB	Spokane, WA
MINOT AFB	Minot, ND

USAF IFC APPROACH

Pilots attempting to land without being fully aware of where they are in relation to the runway continues to be a problem during non-precision straight-in approaches. Some reasons for this are:

- The misconception that approach design guidance is formulated to provide a normal descent at the Missed Approach Point (MAP) for all aircraft from Minimum Descent Altitude (MDA) to the runway.
- Lack of planning for a normal visual glide path to the runway from MDA.

The MAP is just what the name implies. It is the point from which the missed approach commences. It is not, nor was it ever intended to be, the point from which to maneuver to land. Approach design does not attempt to provide normal descent to the runway for all aircraft from the MAP. The MAPs position in the approach is primarily dependent on missed approach criteria. It is seldom dependent on final approach criteria.

As an example, the HI-ILS 2 RWY 31 localizer MAP depiction at Ellsworth AFB, SD, may lead the pilot to believe that at the MAP he will be in a position for a normal descent to the threshold. ILS approaches with associated localizer minima depict the ILS MAP from decision height alone. The instructions adjacent to the timing block, for the non-precision portion, indicate "FAF to MAP 6.2 NM" which places the MAP over the threshold. Most high performance aircraft would require an extremely long runway to safely land if they started descent from the MDA at the threshold.

Let's look at a less extreme example. The MAP is placed at .7 NM from the runway on the TACAN RWY 25, Langley AFB, VA. If the pilot departs the MDA when at the MAP for the threshold, he will need to descend at approximately 5° or 500 feet per nautical mile descent gradient, which will be too steep for some aircraft. For an aircraft on final at 150 KTAS, this would require a vertical velocity of 1325 feet per minute. The pilot should plan the non-precision approach so that he arrives at MDA in a position to make a normal descent. The May 1976 "IFC Approach" article on Visual Descent Points (VDPs) explains in detail how this may be accomplished. VDPs are currently being published on several approaches and will be included on many approaches in the near future. When no VDP is published, the pilot should

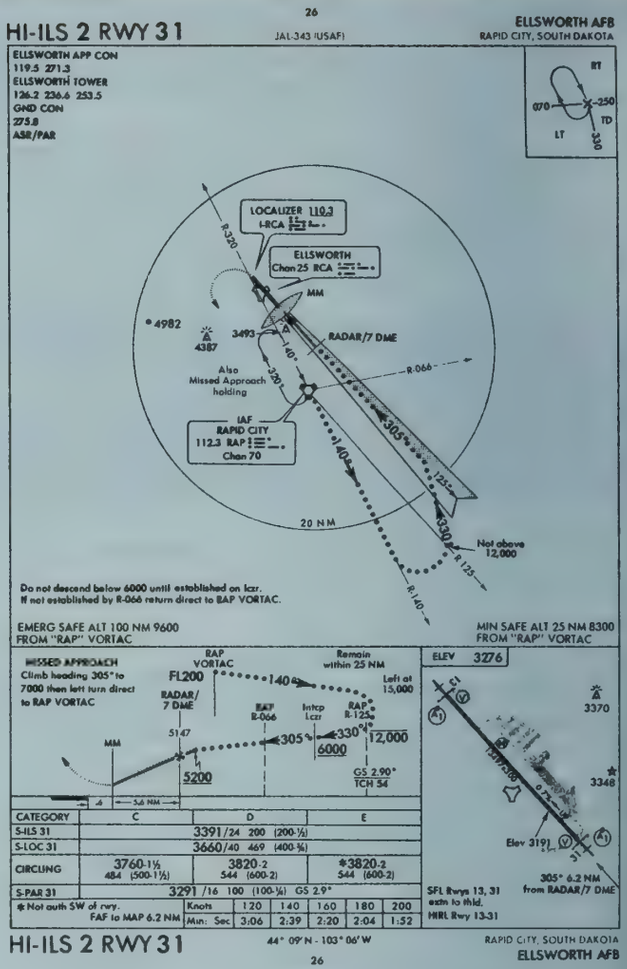
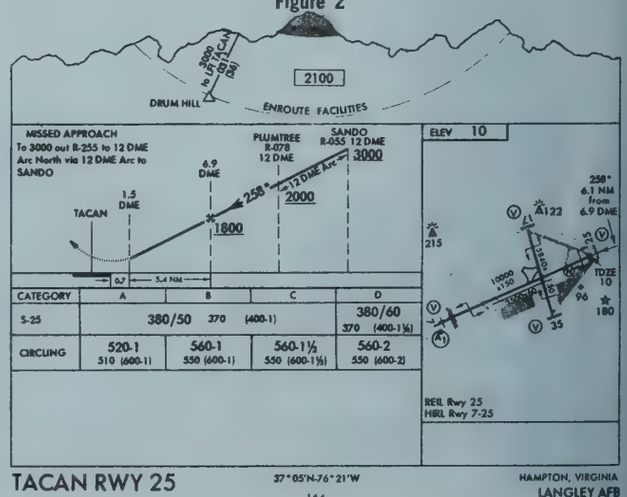


Figure 1

Figure 2



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By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

use whatever is available to define a VDP, such as timing or DME. If this point is computed and overflown while looking for the runway or while descending to MDA, the pilot will at least be aware that if he elects to land he may be descending at a greater-than-optimum rate.

A VDP will normally provide a three-degree descent gradient to the threshold, but the VDP is not necessarily the last practical point from which to land. For each particular approach, each aircraft has a last practical point from which a safe landing can be made. Several variables, such as runway length and aircraft maneuverability, make it impossible to designate such a point on each approach plate. This last practical point, beyond which the pilot is committed to a missed approach, must be determined by the pilot for his particular situation.

If a pilot has no way of determining a VDP or last practical point from which to land, visibility must be such that there is absolutely no question in his mind about where he is in relation to the runway. Although our flying directives define approach lights as part of the runway environment, the pilot may want to remain at MDA if approach lights are all that can be seen. By departing MDA with only the approach lights in sight, he may be flying a dangerously dragged-in final approach or land short due to an illusion of being high. He should be totally aware of his position in relation to the runway and initiate an optimum descent at a pre-computed or published VDP. Copies of the May 1976 "IFC Approach" article may be obtained from the USAF Instrument Flight Center, Randolph AFB TX, AUTOVON 487-4276.

POINTS TO PONDER

Many pilots feel that since they are allowed to file and fly into a field "visibility only," that is, with ceiling below required minimums, that "visibility only" minimums are enough to safely accomplish every approach. Crew members must realize that "visibility only" is a beneficial concept which allows operational flexibility for those experienced enough to use it. However, experience in limited visibility is not a factor of flying hours. It is a factor of having flown into marginal weather conditions often and/or having acquired the habit patterns and knowledge necessary for safe completion of such an approach. To assume that numerous hours of flying time have prepared the crew member for coping with weather conditions of 100 feet ceiling and ¾-mile visibility on a non-precision approach, for example, is a serious oversight. Few of us have had the training or experience to handle these conditions. Therefore, extreme care and thoughtful planning should be exercised, with consideration for the type of ceiling, restriction to visibility, airfield lighting, and aircraft performance, to ensure safe completion of the "visibility only" approach.

Q: Can I depart an airfield on an IFR flight plan and proceed direct to an unpublished radial/DME fix off a TACAN non-co-located with the departure airfield? Also, can I file fix-to-fix navigation between random radial/DME fixes in the route of flight block of the military flight plan?

A: FAA Handbook 7110-65, Air Traffic Control, paragraph 297, instructs air traffic controllers not to accept a flight plan whose route or route segments do not coincide with designated airways or jet routes or with a direct course between NAVAIDS unless the route or route segments are defined as follows:

a. The portion of the route which cannot be defined by a designated airway or jet route or a course between NAVAIDS is defined in the flight plan as a point composed of the following:

(1) A location identifier.

(2) Azimuth in degrees magnetic.

(3) Distance in miles from the NAVAID.

b. The NAVAIDS selected are VOR/VOR-DME/VORTAC/TACAN NAVAIDS authorized for use at the altitude being flown and the distance from the NAVAID should not exceed the distance criteria for the NAVAID being used.

c. The distance between the fixes used to define the route does not exceed:

(1) Below FL 180—80 miles except that for celestial navigation flights. The distance in (2) shall apply between fixes used to define the celestial navigation portion of the route of flight.

(2) FL 180 and above—260 miles.

The key to this discussion is "positive course guidance." If, upon departing an airfield, you have positive course guidance enroute to a designated fix

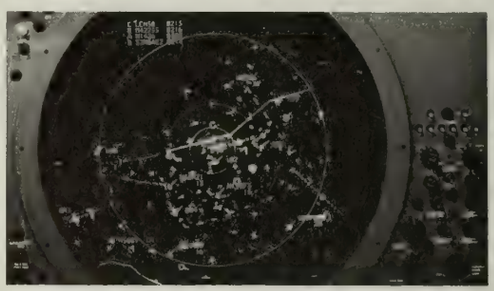
USAF IFC APPROACH continued

or airway/jet route, then it is permissible to enter a random radial/DME fix in the military flight plan, as long as the distance to the fix is within the service volume area of the NAVAID being used for course guidance, and that course guidance beyond the fix is available for continuation of the route of flight. NOTE: Some air traffic control computers will not accept random radial/DME fixes as part of the flight plan.

For a discussion of the military operations authorized to define portions of their routing in accordance with degree-distance routing (fix-to-fix-to-fix), consult the July 1976 "IFC Approach" article.

In addition, when filing to a TACAN-identified Initial Approach Fix (IAF) from other than a published feeder route, ensure that positive course guidance can be provided until reaching that IAF. ★

New SAR Technique



US Army Air Traffic Control Activity

What's up in the way of aid when you are down? Inadvertently that is!

The Department of Transportation is coming up with the answer. Their Federal Aviation Administration (FAA) organization has effectively synthesized computer techniques, radar display facilities, and, of course, personnel skills to exploit these technical resources to improve air safety and rescue operations.

The Department of Transportation is using a spinoff from its computerized air traffic control radar system to help locate downed aircraft in remote areas and speed the rescue of survivors.

Developed by FAA, the new technique uses recorded radar data to reconstruct the flight path and pinpoint where the missing aircraft disappeared from the radar scope.

Since the technique was introduced in 1975, the number of aircraft located through its use has increased steadily from two that year to 14 in 1976 and to 15 through the first 4 months of 1977.

To date the technique is credited with saving one life. That involved the 17-year-old pilot of a light plane that crashed in a remote mountainpass near Lake Tahoe, CA, in March. FAA data enabled them to zero in on the location and get the surviving pilot out before a heavy snowstorm moved into the area. The technique uses a computer program that originally was developed to detect possible malfunctions during testing of the new computerized air traffic control system. This system provides FAA controllers with direct radar readout of such vital information as aircraft identity and altitude. Two years ago, controllers and technicians at FAA's Denver Air Route Traffic Control Center theorized that it also could be used to aid in locating downed aircraft and worked out the procedures with the cooperation of the Air Force Rescue Coordination Center at Scott AFB, IL.

The radar data on aircraft targets is recorded on tape and retrieved for analysis in the form of a computer printout. The printout provides position data on all aircraft that appeared on the radar screen at any given period.

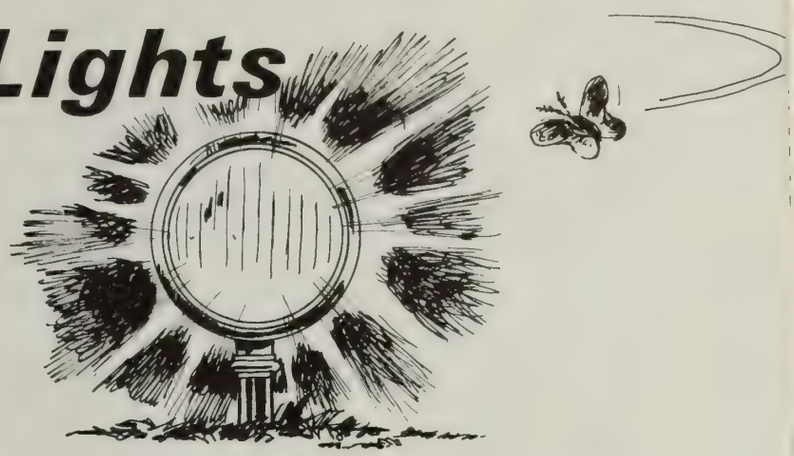
However, using the printout to trace the flight path of a missing aircraft to the point where it disappeared from the radar screen requires skill and specialized knowledge. Only a few controllers in each center presently have the necessary training. Also, because of equipment differences, the technique can only be used at 15 of the 20 Air Route Traffic Control Centers in the country.

So FAA is developing a new computer program that will simplify the task and make it possible for just about anyone in the center to reconstruct a flight path. This involves design and production of special software to enhance the capability of the FAA computer resources to better support the search and rescue mission. All 20 centers are expected to have this capability within the next 2 to 3 years.

Things are looking up in the fine art of looking for you when the need arises.—Courtesy **US Army Aviation Digest.** ★

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Approach Lights In Sight



CAPTAIN JAMES J. LAWRENCE
Directorate of Aerospace Safety

On a hazy summer evening about mid-August, I lounged comfortably in the grass at a local park. As I pondered the mysteries of life, the flight path of a moth caught my eye. It meandered back and forth as if in search of something. I remember being absorbed in the idea of an aircraft with equal maneuverability. As the moth neared a bright light source, its flight path became more direct. It seemed as though this bright light, when discovered through the haze and fog, offered some form of sanctuary for the insect. The moth flew in a straight line toward the ever brightening light source, closer and closer. The moment it reached the alluring light, ZAP! ZAP! One hundred and ten volts zinged through the body of the moth, and its remains split-S'ed onto the ground. I remember thinking "What a sneaky way to kill bugs."

This summertime reverie came back to mind recently as I scanned an NTSB review of approach and landing accidents in the 1970-1975 time frame. Restricted visibility conditions were the major hazards in each accident analyzed. What really caught my eye, was that most of the accidents had occurred after the pilot not flying called the approach lights in sight and the AC went visual. In each case, the aircraft's rate of descent increased rapidly until the crew realized that they would land short. In each case, pull up action was initiated too late, resulting in major aircraft damage and, in some cases, several fatalities.

I began to wonder if someone had set a trap for we pilots. Not wanting to be allured and then ZAPed, I decided to look more closely into this phenomenon.

At first. my research led me to the possibility of false impression by the pilots arising from "visual illusion." That made sense, but it quickly led to incomprehensible terms like accommodation, convergence, stereopsis, static cues, dynamic cues, contextual cues. Fancy diagrams and examples of optical illusions were abundant. These illusion charts are fun, but I find it difficult to directly relate them to this problem. I decided to stick more closely to the NTSB report and attempt to offer practical explanations and pilot options.

Military and civilian pilots are faced with the same mission demands. These demands often require operation in adverse visibility conditions. This fact of life is inescapable and one of the reasons pilots make all that extra money. So, if we have to live with it, how do we deal with it? Proficiency is an answer; but let's assume that stick and rudder-wise, you are the top man. Instrument procedure-wise, you have no equal. You have just flown an ILS that by itself should get you a one on your next OER. At decision height, your copilot has the approach lights and calls "land."

This is where we are in those NTSB accidents studied. These highly skilled pilots flew excellent approaches, had the lights in sight, and proceeded to dive at them much too steeply. They didn't realize their error until it was too late. Sure, the approach lights are the important link between instrument flight and the real world. They provide lateral and roll guidance which the pilot needs to correctly set up his landing on the runway. What they do not provide is any guidance regarding glide slope deviation and angle of descent. They can also produce the potentially dangerous illusion that



At decision height, the pilot picked up the approach lights. He maneuvered slightly to the right to properly align the aircraft for landing. The approach lights, however, offered no information on his aircraft's rate of descent. Right, glide slope information in the form of visual references, VASI, or an outside/inside cross-check would have averted this mishap.

APPROACH LIGHTS IN SIGHT continued

the aircraft is too high or that the nose has pitched up.

This vertical guidance is available, in VFR conditions, by the horizon, the aiming section of the windscreen, and the projected impact point of your aircraft in the landing target area. These are not available in low visibility conditions. If you can see the VASI's, then glide slope information is handy. If you don't have VASI's or cannot yet see them at decision height (which is often the case) you could be in trouble. The pilot may transition to outside references prematurely because of the precise and positive lateral guidance

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the approach lights provide. Additionally, USAF Flight Dynamics Laboratory studies indicate that it can take as long as 5 seconds for a pilot to transfer from heads-down to heads-up reference and derive meaningful data from any visual cues.

Heads-up Displays (HUD), that is aircraft descent, glide slope, airspeed or other information displayed on the aircraft windscreen, would help alleviate this diving for the lights tendency. Only a few aircraft, however, are so equipped with HUD. Most of us have to rely on other information during this critical phase of flight. The NTSB reported several conclusions which emphasize this point:

- Low visibilities compromise the quality and reliability of the visual cues on which the pilot flying relies for vertical guidance; therefore, only the timely and proper integration of flight instrument data into the flight can detect or prevent undesired excursions from the correct flight path.

- Continuous monitoring of the aircraft's flight instruments is necessary from the OM to landing. The duty to monitor these instruments should be assigned as a specific task to a specific crew member.

- Instrument flight procedures should be maintained to the lowest possible altitudes commensurate with the approach procedure. Call outs which can result in a premature abandonment of instrument procedures during the approach should be prohibited. Sighting calls should be limited to visual acquisition of either the airport, the approach lights, the runway lights, or the runway

- Altitude call outs for both visual and instrument approaches should be standardized

- Greater use of the autopilot and approach coupler will augment instrument approach safety The autopilot should remain engaged, if feasible, until descending to the autopilot's minimum certified altitude.

With all this in mind, the question that arises is concerned with the adequacy of visual cues when the pilot makes that decision to land or execute a missed approach. The term runway environment is often used, but an adequate explanation of what is considered to be runway environment is not clearly available. Many pilots feel that the approach lights constitute runway environment. The NTSB has stated that a crew should have the runway threshold in sight at DH or go-around. The NTSB later added that the pilot flying the approach should monitor the instruments continuously until either the runway threshold or runway lights are called in sight.

FAA, ICAO, and some Air Force directives are not quite so specific; they rely on the pilot's judgment to evaluate if the visual cues for the runway environment are sufficient to execute a safe landing. The important point is that there should be no doubt in the pilot's mind that he should continue the approach or get in the throttles and go-around. If he elects to continue, based on the sighting of approach lights alone, he had better integrate the external references with what his aircraft instrumentation is telling him about rate of descent.

After an extended descent in IFR conditions, and a hair raising precision approach to minimums, those approach lights can be a welcome sight. But like that moth, aircrews must beware of being drawn into these lights. Remember that the normal descent rate visual cues are probably not available, and the lights may lead us into flying a rate of descent much higher than is acceptable. To many pilots, this excessive sink rate was not discovered until it was too late for corrective action. If you don't have that HUD, an outside/inside cross-check is necessary to avoid being zapped. ★

OPS TOPICS

SWEET DREAMS

How many physiological incidents does it take to prove a point? Here's another one. A flight test engineering student was being administered his engineering final in an A-37. The profile called for a tech order climb to FL 220, followed by airwork at that altitude. After 20 minutes of flight, the instructor pilot noted that the student was not responding to verbal directions. The IP quickly reached over and selected 100 percent oxygen for the student. Ten seconds later the student began to respond. Post flight investigation revealed a large leak around the upper portion of the student's mask. According to the student, this leak had been present since his training began 8 months prior. This was the first flight for the student where the cabin altitude exceeded 18,000 feet for any length of time. Students, thoroughly involved in the business of learning a new craft, are often the victims of life support equipment oversights. Instructor pilots and the life support personnel can pick up the slack. But the responsibility is still the individual's. How do you stack up?

TO TOW OR NOT TO TOW?

Airlift control element personnel were marshalling a cargo aircraft near a hangar at Aviano AB, Italy. When the marshaller directed a sharp right turn, the aircraft's left wing tip struck the hangar door. WHY? Were taxi guide lines available? Yes! Were wing walkers available? Yes! Two pilots? No, three and the third was busily engaged observing the left wing tip clearance. Five people and not one demanded adherence to the distance clearance criteria published in AFR 60-11. Taxi accidents are costly in terms of repairs and lost mission capability. The sad part is that nearly every taxi accident is avoidable if crew members and marshalling personnel would simply remember "Less Than Ten, TOW."

PIN SIN

A T-33 aircraft made an intentional wheels-up landing on a foamed runway. Fire Department rescue personnel helped the pilot deplane and ushered him off to the hospital. In attempting to safe the ejection seat, it was discovered that the seat pins were not in the aircraft cockpit but in the pilot's jacket pocket. This seat had recently been modified, and the fire department did not possess the correct seat pins.—Major William D. Harrison, Directorate of Aerospace Safety.

BE ON GUARD

Concorde test pilot, Brian Trubshaw, offers these basic rules to follow to eliminate accidents that are blamed on aircrew error:

Be suspicious—don't take anything on trust.

Be prepared—know your emergency procedures.

Be professional—no one ever flies as well as he ought to.

Don't be complacent—it can happen to you, and the day you assume it can't, it will

Don't be overconfident—the day you have all the answers, either retire or start worrying.

Don't be afraid to admit an error—no one is perfect.

OPS TOPICS

THE BENDS

On climbout, passing 13,000 feet, the KC-135's pressure warning light came on. Cabin pressure was at 11,000' and remained approximately 2,000' below the ambient pressure as the aircraft continued its climb. The aircraft commander decided to continue the refueling mission, selecting a lower refueling altitude, because the first set of aircraft receivers were already airborne. After level off, the boom operator checked in that he was OK, but remarked that he could feel the reduced pressure in his joints. The AC instructed the crew to immediately notify him if anyone experienced any other adverse symptoms. After 30 minutes of operations at that altitude, the boom operator reported that he was experiencing sharp pain in one of his joints. The pilot started an immediate descent and the pain began to subside. An uneventful landing was made. The boom operator, however, was still experiencing some pain and was taken to the hospital for treatment. The filght surgeon decided to have this crew member airlifted to Brooks AFB Medical Center for compression chamber treatment.

An excerpt from AFR 60-16, Chapter 6, is repeated for pilots faced with a similar situation: "If it is observed or suspected that an occupant of any aircraft is suffering the effects of decompression sickness, the pilot will descend as soon as practical. Landing will be accomplished at the nearest suitable installation where medical assistance can be obtained. . . ."

COMPLACENCY??

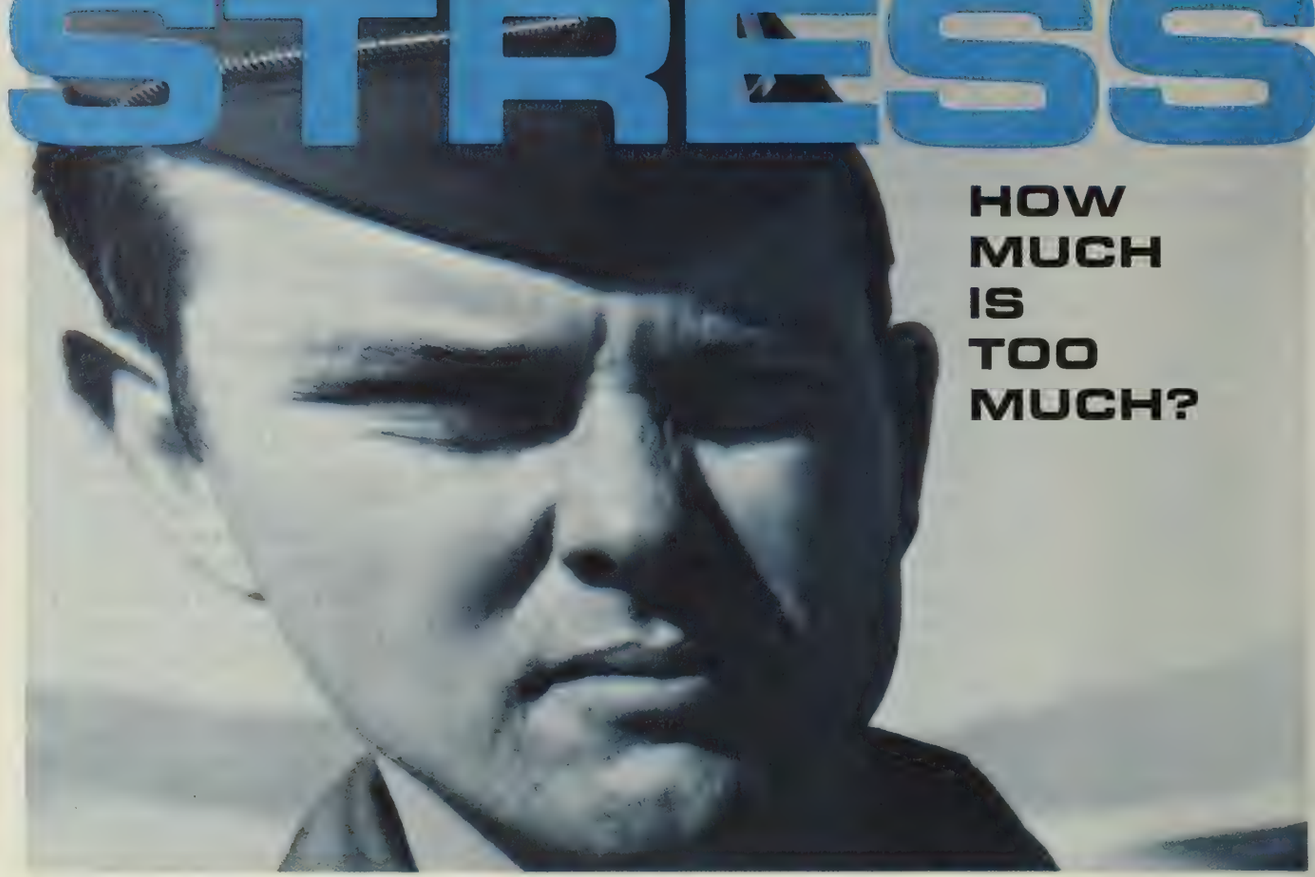
The funny thing about hydroplaning is that it doesn't discriminate against any type aircraft. Little airplane drivers probably daydream of the technological benefits of anti skid brakes and thrust reversers. The big guys, however, must guard against the ever present problem of becoming over confident. Case in point—a C-141 on approach to a Navy base. Weather was reported as 300 feet broken, visibility ¾ mile, with light rain showers. While on downwind, approach control relayed a braking report by another MAC aircraft of fair to poor. Following an excellent PAR, the subject C-141 landed on the 7,500 foot runway and initiated maximum reverse thrust and maximum braking. Shortly thereafter, the aircraft came to a stop off the end of the runway with all tires imbedded 5 to 9 inches in the mud. In between, tire skid marks, runway steam cleaning, a blown number eight tire and seven others with flat spots all indicated severe hydroplaning in the last 1,000 feet of the landing surface. A landing on a short, wet runway with braking action of fair to poor overtaxed the aircraft's and the crew's stopping capability.

4TH TFW BECOMES "DUAL-BASED" WING

The 4th Tactical Fighter Wing, Seymour Johnson AFB, NC, has been named to replace the 49th TFW, Holloman AFB, NM, as Tactical Air Command's "dual-based" unit. Under the "dual-based" concept, two of the wing's squadrons will be operationally committed to US Air Forces in Europe to support US commitments to the North Atlantic Treaty Organization. The 4th TFW is picking up the new mission because the 49th TFW is changing from F-4 Phantoms to the F-15 Eagle air superiority fighter. ★

STRESS

HOW MUCH IS TOO MUCH?



LT COL JOHN R. ALBERTS • Directorate of Aerospace Safety

In 1976 we had the fewest flight mishaps and destroyed aircraft in our history. The resulting conservation of aircraft and personnel, together with the savings in dollars required for repair of damaged aircraft, is an achievement in which we all can take pride. However, close examination of the types of accidents experienced in 1976 shows very little change from the past 15 years. The numbers are smaller as flying time decreases, but the percentage by type remains constant and highly predictable.

There are six types of mishaps that are basically operational in nature and for which prevention is an operational matter:

- Pilot-induced control losses.
- Range mishaps.
- Collision with ground off range (nothing basically wrong with the aircraft).
- Midair collisions.
- Landing and takeoff mishaps (pilot).

Figure 1 shows that the percentage of types of mishaps hasn't changed much over the last 15 years.

The predictability of these mishaps should help us determine where we must place our emphasis to achieve greater reductions in our losses. However, knowing the types of accidents we can expect is only one side of the prevention coin. Unfortunately, we are extremely good at determining "what happened," but terribly poor at identifying "why it happened," especially when dealing with the operations type mishaps listed. This article attempts to answer some of those "whys" as we see them.

Analysis of these operations—people-caused mishaps shows that very few occur because of gross breakdowns in discipline or deliberate and wilful departures from procedures or directives. We find the same true of maintenance type mishaps. In fact, we have found that most are the result of mistakes

Figure 1

TYPE	% 1962-1969	% 1970-1976
Landing (Pilot)	10.0%	10.5%
Collision Ground (Off Range)	11.0%	11.4%
Control Loss (Pilot)	4.0%	4.4%
Midairs	4.5%	4.8%
Range Mishaps	14.0%	12.3%
Takeoff (Pilot)	4.0%	3.8%
TOTAL	47.5%	47.2%

made by good people trying hard. We have noted, however, that more often than not, they also involve a very subtle and sometimes completely overlooked element which can be characterized by a stretching of the rules, a bending of procedures, or a minor deviation from established procedures or tech data. In fact, we find that more than 30 percent of our operational and maintenance mishaps include a factor which indicates something was not quite right—a subtle breakdown in discipline. This is evidenced by indications of:

- Pressing beyond minimum altitudes and airspeeds.
- Stretching weather or fuel minimums.
- Ignoring landing airspeeds and gross weights.
- Failure to follow all of the steps all of the time.

We believe one of the major problems which generate deviations of this type is that, almost always, the result is a victory of some sort or another, rather than a mishap. Consequently, this slight stretching of the rules meets with tacit approval or even encouragement by supervisors and by all others who are attempting to accomplish the same mission. The net result is that it becomes attractive to cut corners, to get the job done, or to fill the squares by whatever means possible.

What is overlooked is the fact that our procedures have been developed over the years through some hard evaluations of what is the best way to accomplish a mission, as well as from very painful lessons learned when we didn't have good solid procedures to follow.

In terms of wins and losses, the risk itself seems minimal at the time. We forget—all of us—that we usually lose the aircraft and sometimes the crew.

We believe many of these subtle breakdowns in discipline are precipitated by a high level of stress within the unit. No matter how it is generated or how it is localized within the unit, stress usually manifests itself in pressure on all personnel to complete the mission as quickly as possible with good marks. The result is always the same:

- Good people making errors in judgment while attempting to get the mission accomplished in a time compressed atmosphere.
- Good people doing a job as best they can.
- Good people attempting a task for which they may not have been trained, or which is above their skill level.

In other words—overcommitment of our people either by themselves or by their immediate supervisors.

Many times, these deviations will have tacit approval, if not the outright support of management simply because *they are the only way the job can be done under the circumstances existing at the time.* Yet, the hard question to answer is why these efforts sometimes manifest themselves in an accident.

Why does a pilot

- try to salvage a bad pass on the range, press minimums, and place himself in a non-recoverable position? (Several have occurred this year on dry passes!)
- delay ejection from an unrecoverable aircraft until the last possible second, or below minimum ejection limits?
- try to salvage a bad landing pattern/approach with plenty of fuel for a go-around?
- continue an approach with weather below minimums with fuel to divert to an alternate?
- continue an ACM intercept not having all aircraft in sight, or below altitude and airspeed limits?
- fly a perfectly good aircraft into the ground?

Why do many of these mishaps happen with another pilot or crew member(s) aboard?

Whys! Many whys, but few real answers. The many of us still around who have had our fangs scraping the floorboards to "try one more shot" really know why, but ours was a victory, not a smoking hole, and I'm afraid the victors too seldom equate the two. Sure, we know "what happened," but how often do we really face up to "why it happened?" Peer pressure? Pride? Overcommitment? Or, all of the above? We believe "all of the above" and that basically the majority is the direct result of management and/or self-imposed stress on the individual(s) involved.

If we are to make further progress in the prevention of mishaps, all of us must be aware of the stresses we place on ourselves, and managers must be aware of the stresses they place on their people —how they are generated, and their results. We must also realize that in military organizations, some stress will always exist. In fact, most people actually perform better under some stress. The hard point is "how much is too much?" *The danger point is reached when the job cannot be accomplished as prescribed.* This is both a management and individual decision. Management must attempt to quantify the stresses placed on personnel; the individual must realize how he reacts under stress, both management and self-imposed.

As the stress level increases, all must expect the corresponding overall impact as well as localized hot spots and make a smart determination on how to reduce that level to normal. If mission requirements preclude it, the next step is to determine what can be done to live with it. We owe it to ourselves and our people. ★

Passenger Briefings

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety



When you are scheduled to carry passengers on your aircraft, how do you handle the passenger briefing? All too often the passenger briefing is relegated to a "quickie" catch-as-catch-can affair as the crew disappears into the cockpit.

Even when the crew tries to give a good briefing, they may be hampered by the fact that they are not really communicating. Not all passengers are pilots or even necessarily experienced air travelers. This means that jargon, technical terms, or obscure references to the operation of aircraft systems will be meaningless to the passenger. We, the aircrew, are usually so familiar with our aircraft that we overlook explanations which another might need to fully grasp the meaning of the passenger briefing.

Ordinarily this is not a big problem but, in the event of an emergency, it can be extremely serious. Here is an extract from the NTSB report on a civil aviation mishap. In this mishap, better briefings would most probably have solved the problem.

"On November 12, 1976, a Dassault Falcon Fan Jet, operated by a large American company, crashed at Naples, Florida. The National Transportation Safety Board's investigation revealed that the nine passengers encountered severe difficulties in evacuating the aircraft because the passengers lacked knowledge of emergency procedures; they were not briefed before departure; and there were no placarded instructions for opening the main cabin door or the two overwing exits.

"Specifically, although a passenger briefing is required by 14 CFR 91.199,* the pilots did not brief the passengers before takeoff regarding the location and

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operation of the main door and the overwing exits. Some of the passengers rarely flew on company aircraft and one passenger had never flown on a company aircraft until the day of the accident. None of these passengers could recall having been briefed by a pilot. Although several passenger briefing cards were available in the cabin, the passengers were not directed to refer to them before takeoff.

*The portion of Title 14, Code of Federal Regulations, pertaining to the FAA.

"In addition, the passenger who occupied the jumpseat did not know that a shoulder harness was available for his use even though he had occupied the jumpseat on several occasions. Although this upper torso restraint was only a single diagonal strap, the Safety Board believes that his chest injuries would have been averted had he worn the restraint.

"The Safety Board also found that, while a placard was attached to the main entry door containing instructions for closing this door, there were no instructions for opening the main entry door. The passenger in the jumpseat tried to open the door after the accident, but he was not able to do so because he did not know that the three door controls had to be actuated in sequence and that the door had to be pushed outward while simultaneously actuating one of the controls. The illustration and accompanying written instructions on the passenger briefing cards did not communicate clearly the location, identification, and proper sequencing of the door controls. The card also failed to communicate that the door would not open unless the proper sequence was followed.

"The timely evacuation also was affected by the lack of instructions for opening the two overwing exits. Requirements for emergency exit operation placards are contained in 14 CFR 25.811. The passengers correctly actuated the handles which unlocked the two emergency exits, but they did not realize that they also had to grasp the hatches and pull them inside the cabin. Neither emergency hatch contained placarded instructions to direct the passengers to pull the hatch away from the fuselage opening. As a result, the two overwing exits were not opened. Our investigation disclosed that the passenger safety card incorrectly illustrated the overwing exit hatch configuration installed in that aircraft.

"Finally, a small carpet on the floor at the main entrance area became wedged underneath the door which separates the passenger cabin from the main entrance area. As a result, the door jammed closed. Placards on this intra-cabin door warned that the door was to remain open during takeoff and landing, but the jumpseat passenger had closed the door before takeoff. The passengers in the cabin were unable to open the door; thus, access to the main entry door was blocked until the carpet was removed. . . ."

AFR 60-16, General Flight Rules, defines the basic requirements for USAF aircraft passenger briefings. The aircraft commander must ensure that all passengers are briefed on safety of flight items. The briefing must include certain items listed in 60-16.

PROCEDURES TO BE FOLLOWED IN EVENT OF AN EMERGENCY

This should include a detailed description of emergency exit routes and the signals for and directions to be followed in an emergency. You might also mention emergency equipment locations (fire extinguishers, etc.).

One other item which was an important factor in the Falcon mishap was that the passengers were unfamiliar with the operation of the doors and emergency exits.

USE AND OPERATION OF LIFE SUPPORT EQUIPMENT

A cabin depressurization is enough to get a pilot's attention, what with lights and horns, but for the passengers it can be really traumatic. Under stress, it is very difficult to remember those quickly mumbled instructions about oxygen procedures.

So, a few extra moments spent during the briefing can help to ease the problems with orygen equipment. During the briefing you should also cover procedures for smoke and fumes in the aircraft and how to use the masks.

PRECAUTIONS, RESTRICTIONS, AND SPECIAL PROCEDURES

Here is where you should cover any special problems or factors relating directly to your aircraft. For example, the T-39 is extremely noisy when the speed brakes are deployed. This can be frightening if a passenger is unprepared. In the accident cited, the intra-cabin door was closesd by a passenger in violation of regulations.

If rough weather is forecast, it's a good idea to brief the passengers and emphasize the importance of seat belts. It could save an injury if you hit some turbulence.

Passenger briefings are a way of life for some aircrews. For others they are a rare and unfamiliar chore, but a most important one. It is a proven fact that the passengers' comfort and safety and even the safety of the aircraft can depend on the quality of the pre-departure briefings. ★

WHY SAFETY?

MAJOR THOMAS R. ALLOCCA • Directorate of Aerospace Safety

The Air Force expends a considerable amount of effort, materiel and funds in support of its philosophy that mishaps constitute a needless waste of resources which can and must be prevented. Is this level of safety effort appropriate? That is a question of infinite complexity which could be addressed by resorting to classical mishap statistics such as improved accident rates, decreases in aircrew fatalities and the like. Or one could wax philosophical about the more esoteric reasons for accident prevention, touching upon factors such as the humanitarian and social benefits which accrue from enhanced safety. But what are the practical, "hard-nosed" reasons for being safe?

ACCIDENTS ARE EXPENSIVE

Mishaps cost money — modern mishaps cost lots of money. In 1964, the average cost of a flight accident approximated $940,000; 10 years later this average figure jumped to 2.2 millions. In 1976, the dollar loss experienced in flight accidents exceeded 250 million dollars. And while these cost figures are heady, some safety experts believe that the true costs of accidents are understated.

There are a number of mishap-associated costs which have not been included when the accidental dollar loss is tallied. For example, destroyed aircraft dollar losses have reflected only the original purchase price of the aircraft and not current year dollars or replacement costs; the costs of injuries or fatalities and the costs to complete the investigation have not been included in the mishap dollar losses; the costs incurred in litigation have not been recorded. If such figures had been included (as they are beginning in 1977) the yearly dollar losses would increase dramatically.

ACCIDENTS DECREASE EFFICIENCY

All mishaps reduce efficiency and effectiveness. They are, furthermore, symptoms that something is wrong. If we agree with the National Safety Council's view that "accidents don't just happen but are caused" then we must also agree that mishaps occur because of a loss of control over people, materiel, processes or the environment. This lack of control will inevitably detract from an efficient and effective operation.

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A mishap always adversely affects the operation of a unit: it is never "scheduled" and often happens at the most inopportune time; it may disable the "top gun" or destroy the "queen of the fleet." At the very least, it is certain to detract from management's performance by pulling key supervisors away from their primary spheres of responsibility—not only to replace the damaged airplane (and crew), but also to arrange for the necessary practice of mishap investigation.

ACCIDENTS HURT MORALE

A high accident rate can destroy a unit's morale. A particularly bad mishap makes everyone in the unit nervous, sometimes apprehensive or fearful. Repeated accidents can give people the impression that their unit does not care about them or, far worse, that the Air Force is not doing all it can to reverse an unhealthy trend. People lose confidence. They lose interest in doing their job well. They lose morale.

ACCIDENTS HURT PUBLIC OPINION

We are, of course, public servants. Building a good reputation among those we serve is second only to building a good reputation among those with whom we serve.

A good safety record enhances our Air Force public image. The Air Force gets to be known as a "going outfit" and "a good place to serve." Unfortunately, however, accidents detract from a well-nurtured reputation quickly and viciously. And this is particularly true for those mishaps which are sensationalized and draw adverse public attention.

So when the taxpayers buy an F-15 or a C-5 or an E-3, it is truly in the best interests of the Air Force to operate it as effectively and safely as possible. Because when we do so we assure the public that we can efficiently manage sophisticated and expensive programs.

ACCIDENTS IMPAIR READINESS

Mishaps detract from the quality and effectiveness of our defense posture.

To wit.

In the five year period from 1972 to 1976, the following numbers and types of aircraft were added to USAF's fleet:

NEW AIRCRAFT ADDITIONS, 1972-76	
Total	1087
Bomber	3
Cargo	130
Fighter/Attack	950
Others	4

(Source: AFLC/LOAC)

In that same five year period, the following numbers and types of aircraft were destroyed in mishaps:

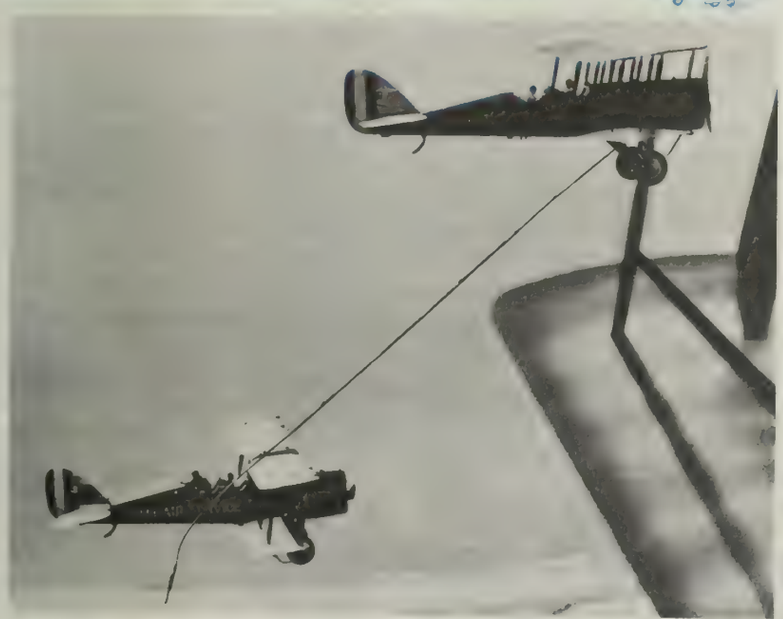
AIRCRAFT DESTROYED, 1972-76	
Total	459
Bomber	23
Cargo	34
Fighter/Attack	301
Others	101

In other words we—through mishaps—negated by almost 50 percent the additions to our coffers over the five-year period. The numbers speak eloquently of the loss in mission capability—and readiness—wrought by accidents.

Accidents hurt. They hurt in the ways outlined in this short article and in many other ways. They are expensive, contribute to inefficiency, wasteful of resources and impair readiness.

Why safety? Because any way you slice it, we can't afford the cost of not having it. ★

Name That Plane



This month's Name That Plane is slightly different. While most early aircraft enthusiasts will be able to recegnize the aircraft, here are some other brainteasers.

1. When were these air refueling tests conducted?
2. What was the endurance record?
3. Name the members of the crew, and the aircraft which convincingly shattered this record a few years later.

For the answers turn to Page 28.

THERE IS A WAY

Annually the Air Force recognizes a given number of individuals, units and commands for outstanding performance in safety. However, competition is keen and not all win major awards. To recognize all of those, AEROSPACE SAFETY is featuring one or more in each edition. In this way we can all share in recognizing their fine performance and, perhaps, learn some valuable lessons.

Nominated For The Chief of Staff Individual Safety Award

TSgt Hubert O'Clair

392d Communications Group (AFCS)
Vandenberg AFB CA

A dynamic program that resulted in an outstanding safety record in 1976 earned this nomination for Sgt O' Clair. Among the many innovations Sgt O'Clair made to the unit program were an AFMV driver improvement course and a special driver training class for young drivers. Both the AFMV and PMV accident rates were reduced. His efforts also improved motorcycle safety and identified serious hazards in other areas that could then be eliminated. The unit safety record reflects Sgt O' Clair's superior performance and dedication to duty.

Lt Col Thomas A. Duke

341st Strategic Missile Wing (SAC)

As Chief of the Safety Division, Col Duke manages missile, nuclear, industrial and traffic safety programs for Air Force elements within a 23,000 sq mile area. In addition, the division is responsible for airfield safety, although there is no locally assigned flying program. The division provides safety services to tenant flying units and transient aircraft at Malmstrom AFB, Montana, which has more than 25,000 approaches and departures per year. Ground safety, however, requires the most attention because of the many miles of roads and traffic within the missile complex and an environment that is conducive to accidents. Under Col Duke's leadership Air Force motor vehicle accidents were reduced by 50 percent and injury accidents to an all-time low. The number of work days lost was reduced from 513 in 1975 to only 130 in 1976. Missile convoys proceeded throughout the complex without incident, and maintenance drivers covered 1.6 million miles with only three reportable mishaps. The many programs, ideas and accomplishments of Col Duke earned him the nomination for the Chief of Staff Individual Safety Award.

Nominated For The Koren Kolligian, Jr., Trophy

Captain John C. Moore

904th Air Refueling Squadron (MAC) • Mather AFB CA

Captain Moore and crew were on a night refueling training mission in a KC-135 when the number 2 engine fire warning light illuminated. When immediate emergency actions failed to extinguish the fire, Captain Moore shut down the engine, began return to Mather AFB, and sent the boom operator aft to visually check the engine. Flames were streaming to the tail of the aircraft. Captain Moore began a high rate descent in turbulence, ice, and thunderstorms which had to be circumnavigated. The fire was extinguished, and Captain Moore made a three engine landing. The fire had burned through the cowling and blackened the strut. If the fire had not been extinguished it could have progressed into the wing and the aircraft might have been lost. Captain Moore analyzed a serious in-flight emergency and took prompt action to prevent loss of the aircraft and possibly some of the crew. ★

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NITE FLITE

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety

A soft night breeze stirred the brush beside the aero club ramp and gently rocked aircraft tied there. With no moon to diminish their glory, the stars in the clear black Texas sky glittered like a jeweler's dream.

A flash of light from a suddenly opened door cuts through the darkness and laughter and conversation shatter the quiet as a group of four walks from the club building and across the dark ramp to their aircraft.

A quick preflight and then the staccato bark of a Continental engine startles an owl perched in a nearby cactus. The small aircraft taxiis out to the runway and soon lifts gracefully into the dark.

A routine flight? Probably. More and more general aviation flights are being conducted at night, and as the frequency of these flights increases so does their exposure to the special problems of night flying.

While most military pilots are trained and highly qualified for night operations, the same is not always true for general aviation pilots. They have much less opportunity for the training that makes night flying safe and fun. This, then, will be a discussion of some of the special problems you will encounter at night.

NAVIGATION

The first and most obvious difference in night flying is the problem of navigation. It is very difficult to navigate at night by map references alone. Even highly trained aircrews find such methods difficult. Thus, it is imperative that any pilot be thoroughly familiar with basic electronic navigation techniques. You should be aware of the procedures and the limitations associated with the equipment in your aircraft. An airways map showing the navigation facilities and Victor airways is a good investment for night flying. But be sure it is current. An out-of-date map can be dangerous.

Some knowledge of instrument approach procedures is also valuable. Tracking in on a VOR final approach is much easier than trying to visually find a field, lost in the bright lights of a city.

NIGHT VISION

The subject of night approaches brings up one of the real differences in night flying—vision. Unlike owls, our eyes are designed for daylight, so we are out of our element at night. This causes problems for pilots. First is lack of depth perception.

It is very difficult to judge the proper approach angle and descent rate at night. The best way to prevent either a short or a hard landing is to use any available approach aids. VASI or ILS glide path guidance is best. Night vision is a fragile thing. Without going into the physiology of rods and cones and visible purple, a good rule of thumb is to allow 30 minutes for night vision adaptation. However, if your eyes have been exposed to extremely bright light during the day—like at the beach or on the ski slopes—the time for night adaptation may be more than twice as long. You can reduce the effect by wearing high quality sunglasses in bright conditions. A hat alone isn't enough. Glare and reflected light are the real problems here.

The other vision related problem in night flying is spatial disorientation. There are so many aspects of this phenomenon which we could discuss that it would take a separate article of its own.

The one really important point is everyone is susceptible to spatial disorientation anytime visual clues are limited.

The best defense is a good knowledge of instrument procedures and techniques. This is also important since at night it is easy to inadvertently fly into unseen clouds and suddenly be totally dependent on instruments thus creating the classic situation for a spatial disorientation accident.

There are many other subjects which can be addressed about night flying, but perhaps the best approach would be a series of short checklist like tips.

- Plan your flight carefully.
- Go over the route and be familiar with the landmarks that should be visible at night. This is particularly important for the arrival airport. Know what the runway environment will look like, where the city is, and have an idea of what the aerodrome light pattern will be. It will prevent a case of temporary disorientation (a nice term meaning lost).
- Check the AIM and NOTAMS for status of approach and lighting aids at destination.
- Make sure your flashlight works.
- Check out the electrical system in your aircraft. Test both the interior and exterior lights. A blacked out approach to a strange field is a thrilling, but rather unpleasant experience.
- FILE A FLIGHT PLAN. (Don't forget to close it after landing).
- Ask for radar flight following if you're VFR. In the terminal areas ask for Stage II or III service or a radar monitored approach.
- Practice night flying often enough to maintain some proficiency in night landings.
- Have an enjoyable flight. ★



"FLYING SAFETY

The perfect end to a

MAJOR JOHN D. WOODRUF

"AND IN CONCLUSION"

Here we are at SHAKEY 13's briefing, (what a weak call sign). It's a standard mission, the same old low level route we've flown hundreds of times. And, of course, afterwards we'll shoot transition at the home drome.

Yes, yes, I know, the same old standard inspections, and we'll taxi and runup at the same old place. Abort procedures, heck, I know that hasn't changed; I'll just grab a few quick winks (commonly known by aircrews as checking your inner eyelids for holes). Yes, yes, I know the departure well, and the recovery procedures haven't changed either. After all, there are only so many ways to recover at an airfield.

Why are they covering emergency procedures? That's why they have you memorize the boldface. Yes, I know the route well; I could fly it blindfolded after the several hundred times I've flown it. The times, locations, headings, and altitudes are all canned. Why do they rebrief this crap? Obstacles and terrain en route . . . I bet they haven't moved any of those mountains lately. Listen to this. Just as I thought, he didn't brief that new TV tower I saw them building last week. Boy, these guys never get the word.

The weather? Sure . . . same as always . . . clear and a million. Why are they briefing alternate airfields? I'm coming home if I have a problem. My wife would kill me if I spent another night out on the road. No new frequencies . . . you'd think they would at least change the radio frequencies every once in a while. And that stupid IFF, only lead has to know that stuff. Everyone else will be squawking standby. Look here, it's those intell weenies again. Time to check my eyelids; you can learn more in *US News and World Report.*

Boy, here's the biggest joke of all—the flying safety officer. And in conclusion . . . "Remember that flying safety is paramount." HA . . . HA . . . HA, is that not the standard ending to all our briefings. What a joke . . . we're all professionals . . . who needs to remind me to fly safe? Why, I'm the safest guy in the Air Force. Remember . . . it's a good landing if you can walk away from it. "Flying safety is paramount" . . . what a joke!

"FLIPPANT ATTITUDES"

How many times have you sat through a briefing and had some or all of the same thoughts cross your mind? Never, I'm sure! Why, they couldn't be talking to me . . . they must be talking to Tom or Joe or one of the new guys. It's

IS PARAMOUNT"

perfect briefing

Directorate of Aerospace Safety



new to them. I've done all this at least a hundred times. And then, there's that comment about flying safe. What a cop out. They say it every time. I know they only say it because they have to . . . it's in a regulation somewhere . . . it's tradition. Besides, I'm gonna get the mission done no matter what. Who needs to remind me to fly safe?

"THE TEXTBOOK ANSWER"

What is "flying safety?" One definition is that flying safety is "the coordinated effort to assure safety of aircraft in flight or in operations directly connected with flight." The safety philosophy evolved out of a needless waste of human and material resources. The safety program is required by public law, and its primary thrust is the prevention of aircraft accidents and the extension of combat potential through resource conservation. Flying safety has many facets: hardware, tasks, attitudes, actions. Awareness of safety is everyone's business. Safety ties all the facets of operations, maintenance, and logistics together.

"THE REAL MEANING"

Let's return to SHAKEY 13's briefing. Really, safety was addressed throughout the briefing. It might not have been labeled as such or maybe we didn't recognize it; but it was there. Why do we have briefings in the first place? Aren't they to inform us of what we are to be doing . . . so we all do the same thing, at the same time, and in the same way. We might think of this as standardization, but doesn't it fall under a higher order "of a coordinated effort to assure safety?" The overriding concern of standardization is safety!

Through the format of a mission briefing, we address safety in its most practical sense. The operations, navigation, weather, communications, and intelligence inputs all address the safety implications of the mission. How safe would our mission be if we all flew our own SID, used a different radio frequency, ignored the terrain and obstacles en route, didn't pay attention to the weather forecast, and all used different procedures.

"THINK ABOUT IT"

The next time you sit down in a mission briefing, think of the relation of all the items covered in the briefing to safety. In some way they all tie in to our flying a safe mission. You and your machine are a scarce and valuable resource. Everything you do—ground training, simulator, written exams, checkrides, mission briefings—is preparing you to fly safely. Flying safety is not a cop out. It brings it all together. ★

Mail & Miscellaneous

Send your ideas, comments, and questions to:
Editor, Aerospace Magazine
Norton, AFB, CA 92409

WHAT EVER HAPPENED TO HANGAR FLYING

Reference subject article. Major Woodruff basically answered his question in his second paragraph if he had just thought about it. I will agree that hangar flying is a super learning experience but it takes time. For the past three years, I have worked as both a flight and academic instructor in TAC. During that period, time has been a premium between student and IP and I would assume it to be the same in an operational squadron. Lack of experienced pilots has forced our student to instructor ratio to about 2 to 1 or 3 to 1 at times. IPs are flying twice a day (10-12 hrs) and student flying once, going to class for 2-4 hours, and simulator, not to mention additional duties. There is no such thing as an instructor with a "free couple of hours" for a "Hangar Flying Session." When we cut money we always cut people and when people are cut the best means of teaching go down the drain.

That is "WHAT HAPPENED TO HANGAR FLYING."

EDWIN C. DENHAM, Captain, USAF
58TTS Instrument Instructor
Luke AFB AZ

HOW LOW CAN YOU GO?

Major Mike Reavey's article "How Low Can You Go?" in Sept 1977 issue was a good mental exercise for me in that it caused my mark one computer to register everything from excitement to total dismay.

The real lesson to be gained from SEA (not to forget Korea, six day, etc.) is that we will need a full bag of tricks when it's our turn at bat again. The low high low profile has its place but it's a lot like caviar, in that it can get pretty damn salty if served a la carte. It needs to be on a nice big silver platter with a lot of alternatives. And lest we get too locked onto the SAM threat, we should remember that there are a lot of other things that can eat you alive right above the tree tops. (Subjective opinion developed by author Circa, 27 July 1965.)

The actual training tips described in the article were presented well (except for the last one). It's a lot like firing on the dart, it's high performance work that helps one to know what is meant by true feather edge flying. So much for your accolades—now let's look at that last sentence once again "P.S. Trim Nose up." ??

Could I have been wrong all these years? Or was I just afraid to push down on a stick that is already close to full forward at 500 knots plus? Any reader that has ever lived through one of the famous 105 roller coaster rides will tell you that full forward trim is the only answer for total and positive control. Airplanes, control sticks and pilots' hands are all designed for pulling, not pushing. Over!!

ROBERT B. PURCELL, Colonel, USAF
Asst Dep Comdr for Maintenance
7th Bombardment Wing
Carswell AFB TX

HOW STABLE IS YOUR F/RF-4?

Aerospace Safety magazine, Jul 1977, carried an article on page 13, by Major Paul Tiley, titled "How Stable is your F/RF-4?" According to the story and chart illustrated, the addition of a centerline tank would increase the stability index of the aircraft from 73.8 to 87.4. However, T.O. 1F-4E-5, page 3-34, Note 3, states: fuselage mounted stores are not used in determining airplane stability index.

Could we, in the field have clarification?

JOSEPH Q. ADDAIR, MSgt, USAF
OL B 32TFS Q.C. Technician
APO New York 09292

We referred your letter to the author who provided this reply. Thanks for writing.—Ed.

"MSgt Addair is correct in stating that TO 1F-4E-5, and the pilot's dash one, state that fuselage mounted stores are not used in determining aircraft stability index.

"In the figure used in the article, the difference between a 'typical' F-4E two tank configuration (73.8) and a 'typical' three tank configuration (87.4) is the addition of a travel pod (BLU-27B unfinned). The titling of the configurations was meant to be a general title." ★

NAME THAT PLANE ANSWER

The answers to our questions this month are:

1. 1923
2. 37 hours, 15 minutes
3. In 1929, a Fokker C-2 called "Question Mark" set a new endurance record of over 150 hours. The crew included Major Carl Spaatz, Captain Ira Eaker, and Lieutenant Elwood Quesada.

If you didn't guess, the aircraft are De Havilland DH 4-B's.



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UNITED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.



Lt Col Louis D. Durham



Capt Mark E. Kuno



TSgt Raymond A. Verbeck



Sr Amn Clem Collins III

601st Tactical Control Wing

On 3 May 1977, shortly after takeoff on an instrument check flight for Colonel Durham, the second-stage hydraulic system on the CH-53C started to fluctuate 200 to 300 PSI. Moments later, the second-stage hydraulic pressure dropped below 800 PSI (normal pressure is 2600 to 3300 PSI) causing the second-stage servo out caution and pressure lights to illuminate. Captain Kuno, displaying outstanding knowledge of the aircraft systems, realized the fluctuation in the second-stage hydraulic system indicated more serious problems. Requesting and receiving clearance to return to base, Captain Kuno, turning to final, elected to turn off the malfunctioning second-stage system. During final approach, the first-stage hydraulic system pressure fluctuated 400 to 500 PSI and there were uncommanded control inputs. Then the utility hydraulic system began to fluctuate 50 to 100 PSI. Captain Kuno turned the second-stage hydraulic system back on to take advantage of any pressure that might be left in the system. The uncommanded control inputs dampened out except for yaw kicks in the tail rotor pedals. Because of the possibility of uncontrolled flight due to the dual hydraulic system failure, Captain Kuno decided to land immediately. By skillful handling, he landed the aircraft in a field approximately 1½ miles from the runway. Captain Kuno's rapid, accurate analysis of an impending emergency together with the teamwork exhibited by his aircrew reflect the highest standards of performance. WELL DONE! ★



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